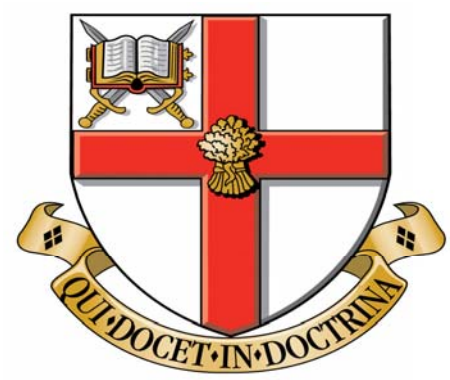


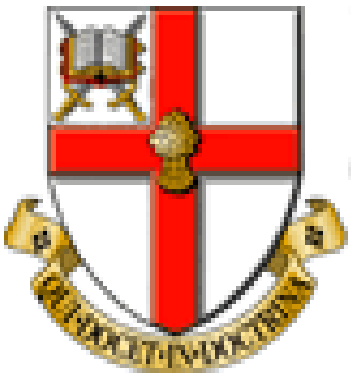
University of Chester

Author(s): Maria Carmela Micallef

Title: Is physical inactivity related to body mass index and waist circumference in a sample of Maltese adult population?

Date: September 2013

Originally published as: University of Chester MSc dissertation



University of Chester

Department of Clinical Sciences
MSc Weight Management

Module Title: Research Project
Module Code: XN7211
September 2013

Assessment Number **H06785**

Word count: Review Paper **5299**
Word count: Research article **4683**

Acknowledgements

I would like to express my sincere gratitude to Dr Stephen Fallows for his guidance and help throughout the whole process of my research project. I am also grateful to Dr Mike Morris for his support and encouragement in data analysis.

I would also like to thank all the lecturers and administrative staff within the Department of Clinical Sciences for their constant support and attention.

Many thanks to the people who answered my questionnaire and to my friends for their patience and understanding though out this year. A special thanks to Anton Buhagiar for his help and guidance.

Finally sincere thanks go out to my husband Dino, my daughter Valentina, my parents and mother in-law for their love, understanding, support and encouragement.

Originality Declaration

This work is original and has not been previously submitted in support of a Degree, qualification or other course.

Signed……

Date……

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Paper 2: Research Article

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Abbreviations

ACSM	American College of Sports Medicine
AHA	American Heart Association
BMI	body mass index
CDC	Centers of Disease Control and Prevention
CMO	Chief Medical Officer
CVD	cardiovascular disease
cm	centimetres
DHIR	Department of Health Information and Research
EASO	European Association for the Study of Obesity
EC	European Commission
EE	Energy expenditure
EHES	European Health Examination Survey
EHIS	European Health Interview Survey
EU	European Union
IARC	International Agency for Research on Cancer
IASO	International Association for the Study of Obesity
IPAQ	International Physical Activity Questionnaire
m	meters
max	maximum
kg	kilogrammes
MET	resting metabolic equivalents
min	minimum
Min	minutes
N	number of subjects in total
n	number of subjects in sub-group
NICE	National Institute of Health and Clinical Excellence
NIH	National Institute of Health
NHLBI	National Heart Lung and Blood Institute
NCDs	non-communicable diseases
OECD	Organisation for Economic Co-operation and Development
PA	physical activity
SD	standard deviation
SPSS	Statistical Package for Social Sciences
UKDH	British Department of Health
UHDHHS	United States Department of Health and Human Services
VO_2 max	maximal oxygen uptake
WC	waist circumference
WHO	World Health Organisation
wk	week
%	percent

General Title:

Is Physical Inactivity Related to Body Mass Index and Waist Circumference in a Sample of Maltese Adult Population?

Title Paper 1:

Physical Activity Levels and Obesity Prevalence Amongst the Maltese.

Abstract Review Paper

Purpose: Plenty of research shows that physical inactivity and obesity increase the risk of many co-morbidities and mortality. The alarming increase in the prevalence of obesity and low physical activity (PA) levels in the Maltese population, which have been documented in a limited number of studies, give cause for concern. The use of body mass index (BMI), waist circumference (WC) and International Physical Activity Questionnaire (IPAQ) are discussed as measures to assess PA and weight status in population based studies.

Method: Different electronic databases were systematically searched for international and Maltese literature and studies related to physical inactivity, physical activity, body mass index, waist circumference and International Physical Activity Questionnaire.

Results: Existing literature show that in many European countries including Malta physical activity levels are low and obesity and overweight is high. This challenging situation is now well recognised by international and national health bodies and lead to the current recommendations of physical activity.

Conclusion: The high prevalence of overweight and obesity and the low levels of physical activity are major risk factors for non-communicable diseases globally including Malta. Most Maltese studies on obesity prevalence and PA levels are based on self reported data, which might not always reflect the true picture. Thus more research is required to help policy makers to design effective programmes to promote more PA and to try and reduce the obesity prevalence amongst the Maltese.

Key words: Physical activity, physical inactivity, obesity prevalence, International Physical Activity Questionnaire, body mass index, waist circumference.

1.1 General Introduction

Physical inactivity and excess weight are two major public health problems (World Health Organisation [WHO], 2000, 2006). In 2008, the worldwide prevalence of overweight and obesity was estimated to be more than 1.4 billion adults (over 20 years), of these over 200 million men and almost 300 million women were obese (WHO, 2008). Furthermore, WHO (2013) estimated that in 2008, globally, 31% of adults aged 15 and over were insufficiently active (28% men and 34% women). This unhealthy behaviour was estimated to cause 600,000 deaths annually and lead to a loss of 5.3 million years of healthy life due to premature death and disability (WHO, 2002). If physical inactivity were to be reduced by 10-25%, more than 1.3 million lives could be saved annually (Lee et al., 2012).

In Malta, the situation is similarly grim. It is troubling to note that Maltese men rank top in European obesity chart and Maltese women place third (Eurostat, 2011). Furthermore, Malta is labelled as one of the most sedentary populations on earth (Stagno-Navarro, 2012), with 71.9% of the population failing to meet recommended levels of PA (Hallal et al., 2012). It was estimated that Malta could gain an increase of 1.2% years in life expectancy if physical inactivity were eliminated (Lee et al., 2012). Lee et al. (2012) revealed that Malta has the highest estimate for coronary heart disease (CHD), type 2 diabetes, breast cancer, colon cancer and all-cause mortality, compared to other European countries, almost double to the European and Worldwide median in all variables (Table 1).

Table 1: *Prevalence of comorbidities related to obesity and inactivity in Malta compared to European and Worldwide median*

	Coronary Heart Disease	Type 2 Diabetes	Breast Cancer	Colon Cancer	All-cause mortality
Malta Median	11.9%	14.7%	19.1%	21.3%	19.2%
European Median	5.5%	6.8%	9.3%	9.8%	8.8%
Worldwide Median	5.8%	7.2%	10%	10.4%	9.4%

Source: Adapted from Lee et al. (2012)

1.2 Background Literature Review.

1.2.1 Physical activity and physical inactivity

1.2.1.1 Definition of physical activity

PA is a complex, fundamental human behaviour. It is part of everyone's daily life and includes a wide range of activities including exercise, conditioning, sports, dance, leisure-time activities, occupation, gardening, transportation, household and family related activities (WHO, 2013). Caspersen, Powell, and Christenson (1985) define PA as "any bodily movement produced by skeletal muscles that results in energy expenditure" (p.126), which can be categorised in different ways, that which is of light, moderate or heavy intensity, that which is wilful or compulsory, or that which is weekday or weekend activities. PA also has volume, duration, frequency, intensity and model type (Cale & Harris, 2005).

1.2.1.2 Definition of physical inactivity

Physical inactivity is defined as a "state in which bodily movement is minimal and energy expenditure approximates the resting metabolic rate" (p.6, International Agency for Research on Cancer [IARC], 2002). It refers to low levels or the lack of PA and sedentary behaviours where little energy beyond resting metabolic rate is used (Sjostrom, Hagstromer, & Ruiz, 2008).

1.2.2 Health issues related to PA and physical inactivity.

PA has been described as the "best buy in public health" (WHO, 2001), as becoming more active is likely to bring significant health benefits. By participating in 150 minutes of PA or the equivalent each week, it is estimated that this reduces the risks of:- ischaemic heart disease by 30%, diabetes by 27%, certain types of cancer by 21 to 25% (WHO, 2013), and premature death 20-30 % (Chief Medical Officer [CMO], 2004). It also lowers the risk of stroke, hypertension and depression (CMO, 2004; Hu et al., 2004; Stephenson & Bauman, 2000; Warburton, Nicol, & Bredin, 2006). In addition, PA is a key determinant to energy expenditure and, hence, very important to energy balance and weight control (Jeffrey, 2000; Wing, 1999; WHO, 2002, 2004).

Physical inactivity is identified as the fourth leading risk factor for global mortality causing an estimate of 3.2 million deaths annually, i.e., 5.5% of deaths globally (WHO, 2009). Research suggests that leading a physically inactive lifestyle has major implications for general health of people worldwide and for the prevalence of

non-communicable diseases (NCDs) such as CHD, stroke, diabetes, cancer and mental health disorder (Bauman, & Craig, 2005; CMO 2004; Lee et al., 2012; Morris, Clayton, Everitt, Semmence, & Burgess, 1990; Pate et al., 1995; Warburton et al., 2006). Thus physical inactivity is as high a risk factor to health, as are smoking and obesity (Lee et al., 2012)

1.2.3 Prevalence of physical inactivity

WHO (2013) estimated that approximately 35% of all people in the WHO European regions are insufficiently physically active. Men tend to be more active than women and it has been revealed that nearly every second woman is insufficiently physically active, especially in high income countries (WHO, 2013). The European Health Interview Survey (EHIS) in 2002, using the International Physical Activity Questionnaire (short form), showed that only 31% of the adult population in the European Union (EU) reached the recommended levels of PA (Sjostorm, Oja, Hagströmer, Smith, & Bauman, 2006). In 2010 the European Commission (EC), using different questions than those used in EHIS (2002), showed that 25% of the respondents across the then 25 EU member states were completely or almost inactive. This shows that despite the efforts to increase PA across all ages, in many countries the message is just not getting across and the level of physical inactivity is still very high.

1.2.4 PA levels in Malta

Data on PA in Malta is lacking but the few available sources (The First National Health Interview Survey [NHIS], 2002; EC, 2004, 2006, 2010; EHIS [Malta] 2008) indicate that, overall, it appears that PA is not very popular with the Maltese public. In 2005, 78% of the Maltese adult population declared that they never spend time on vigorous activity (EC, 2006). This was the highest percentage among a number of EU countries taking part in the study and a considerably higher percentage than the EU average of 45% (EC, 2006). Furthermore, the Maltese subjects in this study declared that they only devote 29.8 minutes a week to vigorous PA and less than one hour of moderate PA a week, compared to the EU average of 91.6 minutes and 2.5 hours a week respectively (EC, 2006).

The NHIS (2002) revealed that PA levels of the Maltese public were very poor (7.1% reporting moderate-intensity PA) and way below desirable levels (Ministry of Education, Youth and Employment, 2007; Department of Health Information and Research [DHIR], 2008). This low prevalence of regular PA could be a contributing factor to the high levels of overweight and obesity, heart disease, diabetes, cancer and other related health risks (Department of Environmental Health – Malta, 2009, Lee et al., 2012). The EHIS (2008) showed a small improvement when comparing PA levels to the NHIS 2002 (both using IPAQ short form). The proportion of Maltese respondents reporting moderate-intensity PA has more than doubled (16%), however the proportion of respondents reporting high levels of PA (26.9%) has remained stable since 2002 (26.3%, DHIR, 2008).

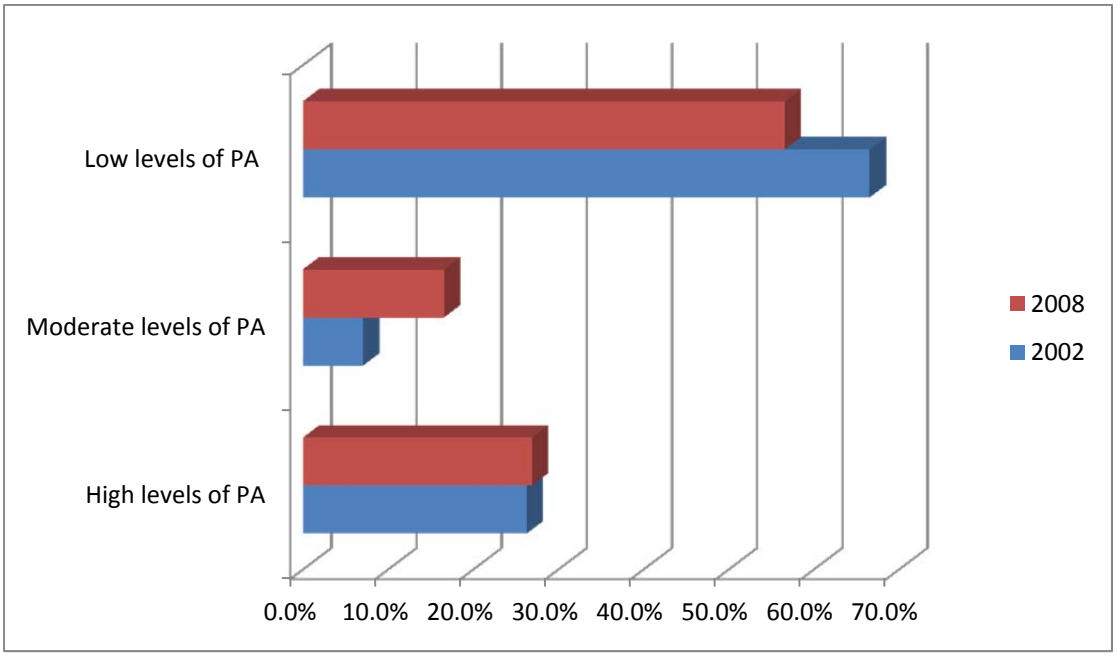

Figure 1: *Physical activity levels in Malta between 2002 and 2008*
Source: Adapted from Department of Health, Information and Research (2008)

A more recent study, published by the EC (2010) on sports and PA, points out that 38% of the Maltese never exercise or play sports. This is one percent less than the European average. One can note an improvement from the previous study in 2004, where 43% of the Maltese subjects stated that they never played sports or exercised (EC, 2004). Furthermore, in 2010, 24% of the Maltese subjects in the study declared that they never engaged in PA and 13% were seldom physically active while the European average was 14% and 20% respectively (EC, 2010, Figure 2).

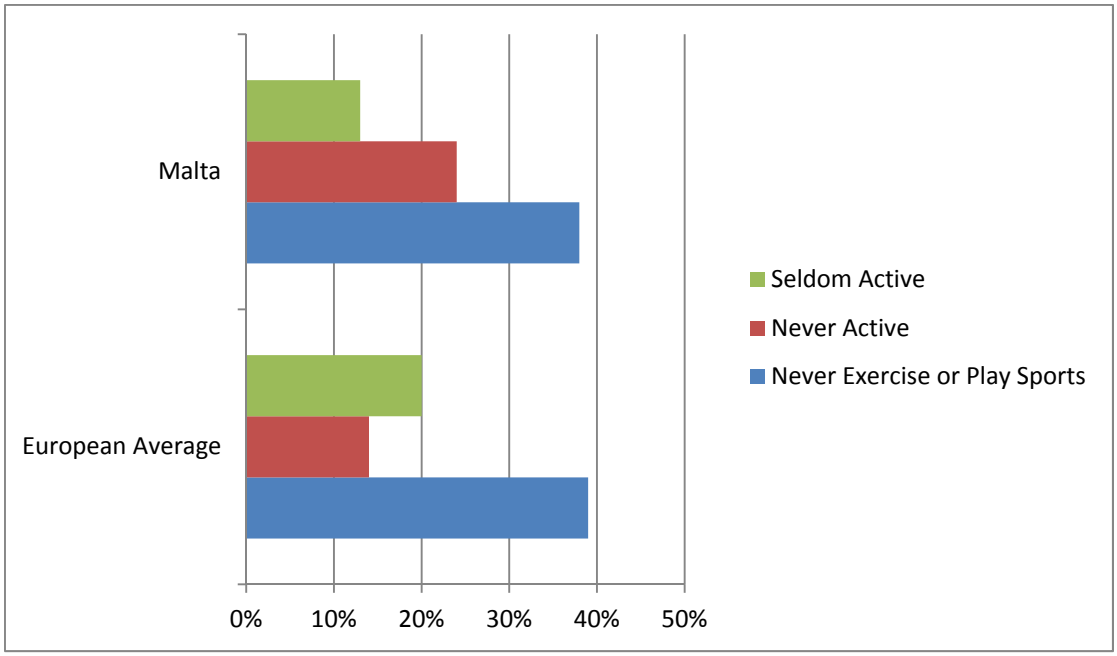

Figure 2: *Participation in exercise and sports by the Maltese compared to EU average*
Source: Adapted from European Commission 2010. PA Special Euro barometer

1.2.5 Assessing Physical Activity

Several methods of assessing PA and energy expenditure (EE) are available (Ainsworth, 2009; Lamonte & Ainsworth, 2001; Westerterp, 2009). These include direct and indirect methods either by assessing the behaviour or the energy cost of that behaviour as it occurs. However, no method is 100% accurate and all have their limitations (Welk, 2002). Direct methods provide a more accurate estimate of energy expenditure as they do not involve elements of recall like indirect methods, however, direct methods require the use of instruments and/or complex measurement systems which may not always render them so practical (Ainsworth, 2009).

1.2.5.1 Direct Methods to assess PA

1.2.5.1.1 Calorimetry and double labelled water

Direct measures include direct and indirect calorimetry techniques. The direct method monitors the body's rate and quantity of energy produced by measuring the body's heat production in a sealed insulated chamber (Miles, 2007; Startling, 2002; Dishman, Washburn & Heath, 2004). This laboratory technique is very accurate (Dishman et al., 2004). The indirect method estimates EE by measuring respiratory gases, where the subject has to wear a mask and carry equipment to analyse expired air (Startling, 2002).

Doubly labelled water (DLW) technique is a biochemical procedure used to assess PA and EE under laboratory and field conditions (Speakman, 1998). It involves measuring integral production of CO_2 by the difference between the elimination rates of ^{2}H and ^{18}O as both water and CO_2 after a loading dose of water labelled with the stable isotopes of ^{2}H and ^{18}O. EE is then determined from CO_2 production (IARC, 2002). This method for measuring EE was labelled as 'gold standard' for the validation of field methods of PA (Melanson, Freedson & Blair 1996; Westerterp & Pasqui, 2004).

These methods are highly accurate, however, rather expensive compared to indirect methods and require the use of specialised equipment making them impractical in large studies.

1.2.5.1.2 Direct observation

In direct observation, a trained observer records PA behaviour for a certain period (McKenzie 2002; Pate, O'Neill & Mitchell, 2010; Westerterp, 2009), This method also has its limitations. The observer can find it difficult to manage and score the data and the classification of observed activities can be subjective. It is very time consuming and intense observation time in the field is required (Sallis, 2010). Furthermore, the presence of the observer might influence the activity behaviour of the subject (Westerterp, 2009).

1.2.5.1.3 Motion sensors and monitors

Motion sensors and monitors which are worn on the body are mechanical or electronic devices such as pedometers, accelerometers, global positioning units and heart rate monitors to measure PA directly (Basset et al., 1996; Bassett, Cureton & Ainsworth, 2000; De Cocker, DeBourdeaudhuji, & Cardon, 2009; Duncan, Badland & Mummary, 2009; Janz, 2002; Maddison, & Ni Mhurchu, 2009; Rowlands, Eston & Ingledow 1997). Although these methods provide reliable and valid result of PA and EE, they, too, have their limitations. Their reliability and validity is specific to the device, the population under study and the physical activity. The way the devise is used and constructed will affect the accuracy of the results (Steele et al., 2003). For example, characteristics of the population, such as, people with limited mobility can have an impact on the result of the motion sensor as slow movement might not be detected. Further more, the activity being monitored will also affect the validity of activity measured (Steele et al., 2003).

1.2.5.2 Indirect methods to assess PA

Indirect methods include PA diaries, logs, interviews and recall questionnaires which provide a detailed account of all, the PA performed during a specific period of time (Ainsworth, 2009; Lamonte & Ainsworth, 2000; Mathews, 2002; Sallis & Saelens 2000; Westerterp, 2009). Logs and diaries can identify:- the type of activity performed, such as, walking, gardening, and lifting; the purpose of activity, such as, home maintenance and transportation; the duration, such as, minutes; self-rating intensity (light, moderate or vigorous); and body position (standing, walking, sitting) for all the activities performed within a period of time (Ainsworth, 2009). Self-reporting, recall questionnaires/surveys are used more frequently to assess PA and EE in large scale epidemiological studies as they are fairly inexpensive and non-reactive methods (Lamonte & Ainsworth, 2000). Recall questionnaires can reflect various domains of activities, such as, exercise, occupational, leisure time, gardening, family care and transportation. However, these have the fundamental problem of recall bias (Ainsworth, 2009; Rutten et al., 2003), for instance, certain strenuous activity tends to be recalled more accurately than moderate-intensity activity (IARC, 2002). Rutten et al. (2003) argue that time spent in vigorous-intensity activity can be overestimated while habitual daily activity such as walking can be difficult to recall, hence, may be underestimated (Bassett et al., 2000).

1.2.6 International Physical Activity Questionnaire (IPAQ)

In response to the global demand for comparable and valid measures of PA within and between countries, the IPAQ questionnaire was developed in 1997 by a

multinational working group supported by WHO as a comparable and standardized self-report instrument to measure multiple domains of PA levels across different countries and socio-cultural environment, targeting people between 18 and 69 years of age (Craig et al., 2003; Rutten et al., 2003; Maddison et al., 2007).

The IPAQ questionnaire has a short (7 items) and long version (27 items), both involving a seven-day recall PA form, which can be self-administered or done via telephone or through personal interviews. The short form is suitable for measuring PA in international and regional surveillance systems. The long form is more suitable for interventions that require more precise PA quantification as it provides more detailed information and measures four domains of PA (IPAQ, 2005). These include occupational (7 items), transportation (6 items), garden and household tasks and family caring (6 items), leisure time (6 items), plus, it collects data on total sitting time (2 items) (IPAQ, 2005; Maddison et al., 2007; Van der Ploeg et al., 2010).

A reliability and validity study of the measurement properties of IPAQ was held across fourteen centres from twelve developed and developing countries (Craig et al., 2003). The results demonstrated that all IPAQ questionnaire versions produce reliable data (Spearman's *r* of 0.81 for the long form and 0.76 for the short form) and acceptable criterion validity against CSA accelerometer (*r* = 0.30), and 75% of test-retest correlation coefficient (within the same week) in the twelve countries were above 0.65 (Craig et al., 2003). Since then, the IPAQ has been investigated internationally for validity and reliability and used in different settings and different

populations (Ali-Vasheghani-Farahani, et al., 2011; Bauman et al., 2009; Craig et al., 2003; Johnson-Kozlow, Sallis, Gilpin, Cheryl, & Pierce, 2006; Hagströmer, Oja, & Sjöström, 2007; Lee, Macfarlane, Lam & Stewart, 2011; Macfarlane, Lee, Ho, Chan, & Chan, 2007; Van der Ploeg et al., 2010).

The IPAQ was further tested for validity and reliability against DLW where a moderate correlation (r = 0.31), was reported (Maddison et al., 2007). The test-retest reliability coefficient (Spearman correlation coefficient) was 0.79 ($p < 0.0001$) between zero and eight days and 0.74 ($p < 0.0001$) between eight and fifteen days. Although the sample size was small (n = 36), the study supports the use of the IPAQ (long form) as a measure of PA for the purpose of epidemiological studies. However, a systematic bias towards underestimation of PA related EE at higher levels of PA was reported (27% deficit).

1.2.6.1 Strengths and weakness of IPAQ

The IPAQ questionnaire has its strengths and weaknesses. One of its strengths is that since it measures multiple domains of PA, it has higher overall PA estimates as part of global surveillance compared to other surveys that capture leisure time activities only (US Department of Health and Human Services [USDHHS], 2008). However, some respondents might find it difficult to distinguish between moderate and vigorous activities (Slattery & Jacobs, 1995). Another limitation is that with self-reported measures, such as the IPAQ, there is a tendency of overestimate or underestimate PA compared to direct measures or modified procedures (Maddison et al., 2007; Prince et al., 2008; Rzewnicki et al., 2003; Sallis & Saelens, 2000).

Additionally, the IPAQ scoring protocol does not reflect the intensity of all activities for everyone. For example, a participant who indicates that he/she walks 30 minutes 5 days a week has used an equivalent 495 METs min/week. However, different variables such as weather and geography may affect one's walking speed and intensity which will, in turn, affect the 3.3 METs (Ainsworth et al., 1993), which can result in misrepresentation of the energy cost of the activity (Maddison et al., 2007). Another weakness is that individuals who are physically fitter than others may rate moderate and vigorous activity differently compared to those who are more sedentary and less fit, thus, confounding self-report derived EE (Maddison et al., 2007).

1.2.7 PA recommendations and guidelines

Evidence based on public health recommendations have been issued since 1995 (US Center for Disease Control and Prevention [CDC] and American College of Sports Medicine [ACSM]). The CDC/ACSM (1995) recommendations state that "every US adult should accumulate 30 minutes or more of moderate intensity PA on most, preferably all days of the week" (Pate et al., 1995 p. 402). The purpose of this recommendation was to encourage sedentary US adults to increase their PA levels and to improve their general health and disease prevention. This recommendation created some controversy because it suggested that the activity can be accumulated in bouts of at least six to ten minutes which was different from the previous recommendations that emphasised on one longer continuous and rather strenuous session (ACSM, 1985).

This recommendation has been adopted worldwide (Oja & Titze, 2011) and since then a general consensus has been reached on the amount and type of PA recommendations to improve and maintain health (CMO [UKDoH], 2004, EASO [Tsigos et al.,] 2008; USDHHS Physical Activity Guidelines for Americans, 2008; USDHHS - Surgeon General's report and the US National Institute of Health Consensus Report, 1996; WHO, 2000, 2004, 2010). Table 2 shows the development of PA recommendations for adults by various organisations.

WHO (2010) adopted the updated evidence based recommendations by ACSM/ AHA, 2007 (Haskell et al., 2007) and recommended that adults aged 18-65 years engage in at least 150 minutes of moderate-intensity aerobic PA weekly in addition to performing regular strength and flexibility training or at least 75 minutes of vigorous-intensity aerobic PA throughout the week or an equivalent combination of moderate and vigorous-intensity activity. Furthermore, WHO (2010) recommends that for additional health benefits, adults should increase their moderate-intensity aerobic PA to twice the recommended amount (300 minutes per week or 150 minutes of vigorous-intensity aerobic PA per week or an equivalent combination of moderate and vigorous-intensity activity).

Table 2: *Development of PA recommendations for adults*

Organisation	Date	Recommendation	Rationale
AHA/ACSM (first guidelines)	1975	3- 4 times a week for 20 – 60 minutes at 70 -85% max HR.	Health and fitness
ACSM	1978	3-5 times per week, 15-60 minutes each time, 60-90% max HR. Stressed on continuous aerobics activity.	Health and Fitness
CDC/ACSM, Pate et al.	1995	30 minutes of at least moderate-intensity on most, preferably all days of the week which can be accumulated in bouts of at least 10 minutes duration.	Health
CDC, US Surgeon General report	1996	Start moderate levels of PA for 30 - 45 minutes 3 to 5 days a week with long term goal of accumulating at least 30 minutes or more of moderate-intensity such as walking on most, and preferably all days of the week.	Health
ACSM,	1998	3-5 times per week, 20-60 minutes each time, 50- 85% max HR on aerobic exercise and include strength and flexibility training.	Maintaining or improving fitness.
IASO, Sairs et al.	2003	For prevention of obesity: 45-60 minutes per day of least moderate- intensity activity.	Prevention of obesity
		For maintenance: 60-90 minutes per day of moderate-intensity or lesser amount of vigorous-intensity activity.	Maintain weight loss.
IOM, Chief Medical Officer	2003	Prevention of excess weight: 60 minutes a day.	Prevention of obesity.
WHO	2004	30 minutes of moderate-intensity activity on most days of the week.	Health

Table 2 (Continued) **Organisation**	**Date**	**Recommendation**	**Rationale**
Department of Health UK, Chief Medical Officer	2004	At least 30 minutes a day of moderate-intensity PA on 5 or more days a week.	Health
		45- 60 minutes of moderate-intensity of PA a day to prevent obesity.	Prevention of obesity
ACSM/ AHA Haskell et al.	2007	30 minutes of at least moderate-intensity activity daily or 20 minutes of vigorous activity 3 times a week, in addition to 2 times a week of strength training.	Health and Fitness
		150-250 min/week of moderate-intensity PA.	Prevention of weight gain
		More than 250 min/week of moderate intensity PA.	Weight loss and weight maintenance after loss.
USDHHS, Physical Activity Guidelines Advisory Committee Report.	2008	Adults aged 18-64: 150 minutes of moderate-intensity PA a week or at least 75 minutes of vigorous PA a week or the equivalent combination per week in addition to strength training in bouts of at least 10 minutes. More health benefits are gained if PA is doubled. Suggest that some activity is better than none.	Health
WHO	2010	Recommendations are specific to age group. All adults aged 18-65: 150 minutes of moderate-intensity PA a week or at least 75 minutes of vigorous PA a week or the equivalent combination per week in addition to strength training.	Health and fitness
Department of Health, PA, Health Improvement and Protection UK	2011	Should be active at least 150 minutes a week (30 minutes, 5 times a week) at moderate-intensity or 75 minutes of vigorous-intensity exercise a week or combination of both. Should also include strength training at least twice a week and reduce the time spent being sedentary as much as possible.	Health

1.2.8 Maltese recommendations for PA

The current Maltese PA guidelines promoted by the Department for Health Promotion and Disease Prevention (2008) recommend that all adults should achieve at least 30 minutes of moderate-intensity aerobic activity daily which can be accumulated in bouts of 10 minutes. This recommendation appears to be sufficient to reduce health risks.

As part of the promotion to encourage PA on daily basis for people of all ages throughout Malta and Gozo the Health Department issued a PA pyramid which illustrates activities to be carried out throughout the week for weight control and to feel physically and mentally healthy (Department for Health Promotion and Disease Prevention, 2008). The activities are in decreasing order of preference with those activities that one should do mostly on daily basis such as sweeping, going up the stairs and walking the dog at the base of the pyramid, followed by, aerobic activity which is recommended three to five times weekly. Resistance activities are more toward the top and those that one should do less frequently, such as, sedentary activities at the top of the pyramid. Figure 3 illustrates the Maltese physical activity pyramid.

Figure 3: *Physical Activity Pyramid for the Maltese adults issued by the Maltese Health Department*

Source: Department for Health Promotion and Disease Prevention (Malta). 2008. Caqlaq għal Saħħtek. Msida, Malta: (Author)

1.3 Obesity

1.3.1 Obesity and health implications related to obesity

The worldwide rapid increase in the prevalence of overweight and obesity in the last few decades has been a growing public health challenge as it is creating a

"health crisis" in the form of an "obesity epidemic" (WHO, 2010). Obesity is a chronic disease and like physical inactivity, it has become a serious threat to health. It is estimated that excess weight is responsible for 2.8 million deaths annually, i.e., 4.8% of global mortality (WHO, 2009). A number of diseases and disorders including diabetes, CHD, stroke, certain forms of cancer, back pain, musculoskeletal problems, respiratory problems, loss of function and psychological problems have all been linked to obesity (CMO, 2004; Haslam & Wittert, 2009; National Heart, Lung and Blood Institute [NHLBI], 1998; OECD, 2010; WHO 2000). Furthermore, obesity doubles the risk of all-cause mortality and reduces life expectancy by an average of nine years (CMO, 2004). Similar findings were reported by Fontaine, Redden, Wang, Westfall, and Allison (2003), where they concluded that obesity at the age of 40, reduced life expectancy by seven years.

1.3.2 Definition of obesity and factors causing obesity

WHO (2013) defines obesity and overweight as "abnormal or excessive fat accumulation that may impair health". Obesity can also be expressed as excess weight in relation to height (WHO 2000), which is called the body mass index (BMI) where individuals are classified into weight categories (Prentice & Jebb, 2001). BMI is defined as a person's weight in kilograms (kg) divided by the square of his/her height in meters (kg/m^2).

Obesity is complex and multi-factorial (Haslam & James, 2005). It results from a long term positive energy imbalance, where energy intake exceeds energy

expenditure over a long period of time (WHO, 1997; Bouchard, Blair, & Huskell, 2006). Thus, reduction in PA levels is assumed to be one of the main factors for the rapid increase in overweight and obesity (WHO, 2010). However, behavioural, cultural, environmental, social, physiological, metabolic and genetic factors all play an important part (NHLBI, 1998). Additionally, the changes in culture and environment, such as, the increased availability of high energy dense foods, increased portion sizes, low PA levels and increased sedentary lifestyle, as well as, eating disorders, are contributing major factors that had an impact on the observed changes in the prevalence of the obesity epidemic over the last 50 years (Tsigos et al., 2008).

1.3.3 Assessment of overweight and obesity using BMI and WC

BMI and WC are common ways to assess obesity as they are considered practical, easy and inexpensive to administer and valid and reliable tools to provide possible proxies to measure total body fatness (Flegal et al., 2009; NHBLI, 1998; Prentice & Jebb, 2001)

1.3.3.1 Body Mass Index

BMI originally known as the Quetelet Index, is not a perfect measure of obesity, but, it is a valuable and practical tool for public health. In 1995, WHO recognised BMI as suitable method to classify into broad categories an adult person's weight as normal, overweight or obese. Table 3 shows this classification.

Table 3: *Cut-off points of BMI for the classification of weight*

	Obesity class	***BMI (kg/m^2)***	***Popular description***
Underweight		<18.5	Thin
Normal		18.5-24.9	Healthy, normal or acceptable weight
Overweight		25.0-29.9	Overweight or 'preobese'
Obese	I	30.0- 34.9	Obese
	II	35.0-39.9	Obese
Extremely obese	III	40<	Morbidly obese

Source : Adapted from WHO Expert committee 1995- PA status. The use and interpretation of Anthropometry. Tech Report series No 854. Geneva WHO;

Preventing and Managing the Global Epidemic of Obesity. Report of WHO consultation of obesity . Series No 894. WHO Geneva June 1997

Research results suggest that BMI is correlated with direct measures, such as, underwater weighing (Willet, 1998), dual-energy X–ray absorption and magnetic resonance imaging (Rothman, 2008; Janssen et al., 2002a). Janssen et al. (2002a) found a correlation between BMI and total body fat percentage r = .92 and .78 in women and men respectively. Thus, BMI provides an acceptable approximation for assessment of total body fat for the majority of subjects (Janssen et al., 2002a; Flegal et al., 2009) and can be used to classify people on terms of excess body fat (IARC, 2002).

BMI provides a practical indicator of the severity of obesity, nevertheless it has its limitations and can be an imperfect way to measure obesity especially if BMI

measured is based on self-reported weight and height (Maddison et al., 2007). Some limitations include that it does not take into account sex, age, ethnicity, variance in bone density, muscle mass and body fat distribution and may not correspond to the same degree of fatness or associated health risk in different individuals (Carroll et al., 2008; Ellis, 2000; Jackson, Ellis, McFarlin, Sailors & Bray, 2009; Prentice & Jebb, 2001). For example, a person with a high percentage of lean muscle mass may have a high BMI and it can underestimate body fat in individuals who have lost muscle such as the elderly (IARC, 2002; NHLBI, 1998). This can lead to misclassification of individuals with respect to body fat and that miscalculation can in turn introduce bias in studies.

Janssen et al. (2002a), in their study, concluded that although BMI and WC combined were highly correlated with percentage body fat for both sexes (r = .92 and .79 in women and men respectively), WC independent of sex was a stronger correlate to abdominal and visceral fat than BMI (Abdominal fat: WC r = .73 and .68 in women and men respectively; BMI r = .68 and .76 in women and men respectively. Visceral Fat: WC r = .76 and .55 in women and men respectively, BMI r = .60 and .46 in women and men respectively, $p < 0.001$). On the other hand, Flegal et al. (2009) reported that percentage body fat was significantly highly correlated with WC than with BMI in men ($p < .00001$), but significantly more correlated with BMI than WC in women ($p<0.0001$). Furthermore, Janssen et al. (2004) concluded that although BMI is a significant predictor of metabolic health risk, their results suggest that WC (abdominal fatness) is a better marker of health risk than BMI, and BMI and WC together provide a better predictor of abdominal fatness than BMI alone (Dagan, Segev, Novikov & Dankner,

2013; Janssen et al., 2002a; Janseen, Katzmarzyk & Ross, 2002b). Therefore, WC should be given more importance in obesity classification systems, as it reflects adipose rather than muscle tissue and may thus be a more precise estimate of overall adiposity than weight alone or BMI (IARC, 2002).

1.3.3.2 Waist Circumference

WC is a simple, inexpensive and convenient way that provides information on the distribution of body fat (Brown, 2009) as opposed to BMI (Dagan et al., 2013). Research indicates that WC correlates positively with abdominal fat content (*r* = .87 and .68 in women and men respectively, Janssen et al., 2002a) giving an acceptable indication of the severity of abdominal obesity (Abate, Gorge, Peshoch Stray-Gundersen, & Adams-Huet,1996; Albu, Murphy, Frager, Johnson, & Pi-Sunyer, 1997; Janssen et al., 2002a; Janssen et al., 2004; Lean, Han, & Morrison, 1995).

Lean et al. (1995) developed sex specific WC cut-off points by comparing WC and the BMI in a large and heterogeneous sample of white men and women. In that sample a WC of > 94cm for men and > 80 cm for women corresponded to BMI of > 25 kg/m^2 whilst WC of > 102cm for men and 88 cm for women corresponded to a BMI of 30, with only about two percent of the sample population being misclassified. These cut-off points were then adopted by WHO (1997, 2000) and used in NHLBI (1998) guidelines and other studies as an indication of health risk factors and obesity related disease (Janssen et al., 2002b). However, in individuals with very high BMIs, over 35

kg/m^2, the WC will lose its predictive power as usually, these individuals have greater WC than cut-off points (NHLBI, 1998).

Table 4 *Sex specific cut-off points for WC*

	Low Risk	***Increased Risk***	***High risk***
Men	<93cm	94 -101 cm	> 102 cm (> 40 inches)
Women	<79cm	>80-87cm	> 88 cm (>35 inches)

Source: Adapted from Lean, Hans and Morrison (1995)

1.3.4 Waist circumference in Maltese study

The 2010 European Health Examination Survey (EHES) pilot study (DHIR 2012), which is the only study in Malta that gives measured WC, revealed that the average WC amongst males was 96.6 cm, which is within the 'increased risk' category but below the threshold for 'high risk'. Whilst the average WC for females was above the 'high risk' threshold with an average of 89.3cm.

1.3.5 Obesity prevalence in Malta

As in many other European countries, in Malta (Figure 4a and 4b), overweight and obesity is a major public health concern. The existing literature points to a high prevalence of overweight and obesity in the Maltese population (MONICA, 1984 cited in DHIR, 2012; NHIS , 2003; EHIS, 2008; EHES Pilot study, 2010, Eurostat, 2011). Table 5, compares the results of NHIS, (2002) and EHIS (2008) with regards to overweight and obesity prevalence in Malta over the six year period using self reported measures.

Table 5: *Overweight and obesity in adults between 2002 and 2008*

	Overweight			***Obese***		
	Men	Women	Av Total	Men	Women	Av Total
EHIS 2002	40%	29%	35%	25%	21%	23%
EHIS 2008	45%	28%	37%	24%	21%	22%

Source: DHIR (EHIS) 2008,

When comparing the 2008, EHIS results to other EU states, for which data is available, Malta has the highest rate of obesity amongst males (24.7%, circled in figure 4) and the third highest rate amongst females (21.1% , circled in figure 2). This is much higher than the EU average of 16.5% and 16.7% respectively (OECD, 2010).

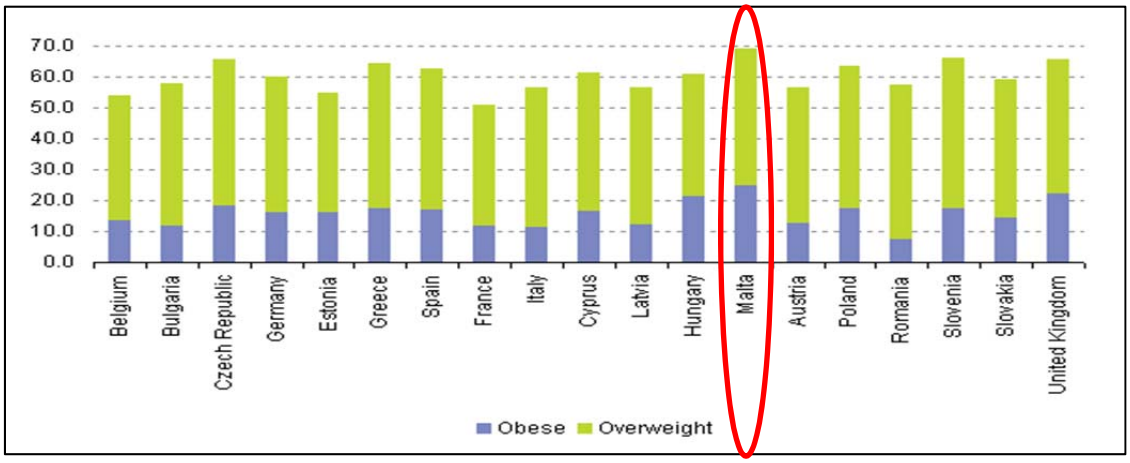

Figure 4a: *Males prevalence of obesity and overweight in Europe*
Source: Overweight and obesity - BMI statistics (Eurostat, 2011)

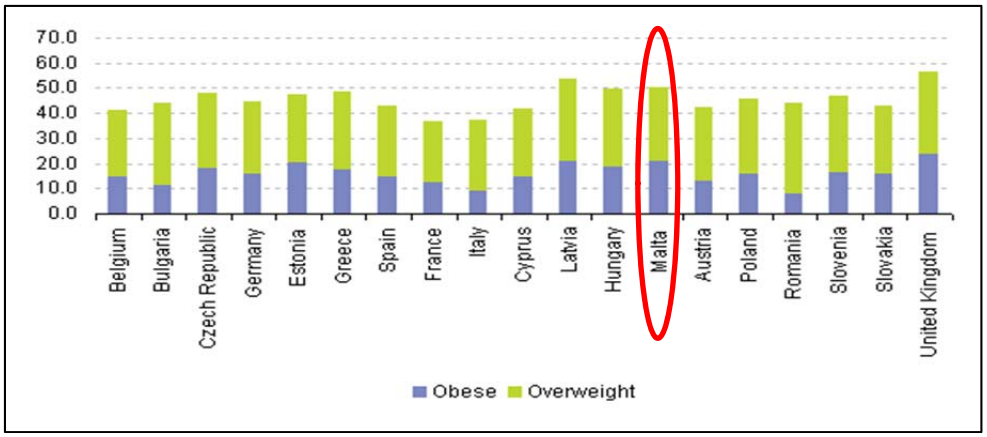

Figure 4b: *Females prevalence of obesity and overweight in Europe*
Source: Overweight and obesity - BMI statistics (Eurostat, 2011)

MONICA (1984, cited in DHIR, 2012) and the EHES Pilot Study (2010, DHIR, 2012), both health examination surveys that give measured data of height and weight in a sample of Maltese adult population between the ages of 25 and 64, indicate that during a 26-year period the proportions of overweight and obesity have remained fairly stable, with only 1% drop in overweight in the same age group (Table 6).

Table 6: *Comparison of results from MONICA 1984 and EHES Pilot Study 2010*

	Overweight	***Obese***
1984 (MONICA)	38% men and women	29% men and women
2010 (EHES Pilot study)	37% men and women	29% men and women

Source: DHIR (2012), European Health Examination Survey Pilot Study 2010.

However, over this period more males have become obese, (22% in 1984, 30% in 2010) while there is a shift of BMI for women towards a normal weight when compared with

the 1984, MONICA study. In 1984, 35% of women were obese, while in 2010, the percentage was reduced by seven, and the proportion of women who are of normal weight has increased from 33% in 1984 to 45% in 2010.

1.3.6 Conclusion

One has to take into account that most studies on PA and weight involving Maltese population were based on self-reporting of PA. Only the MONICA (1984) and EHES Pilot study (2010), use measured weight and height. Self-reporting may provide biased estimates of the levels of PA and the prevalence of obesity and overweight in these studies (Graff-Iversion et al., 2007; McAdams, Van Dam, & Hu, 2007; Pirie, Jacobs, Jeffery, & Hannan, 1981; Rzewnicki et al., 2003; Wing, Epstein, Ossip, & La Porte, 1979). Nevertheless, the existing literature appears to point to a high prevalence of overweight and obesity and low levels of PA amongst the Maltese. The fact that both excess weight and lack of PA are closely linked to comorbidities and premature mortality (Ainsworth & Macera, 2012; CMO, 2004; Hardman & Stensel, 2009; Hu et al., 2004; Lee et al (2012); NHLBI, 1998; USDHHS, 1996; Warburten et al., 2006; WHO, 1997, 2004) and that the Maltese rank high in EU obesity chart, highlights the necessity to investigate if the lack of PA levels and weight status among the Maltese adult population are correlated.

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Research Article

Title Paper 2:

Is Physical Inactivity Related to Weight Status in a Sample of Maltese Adult Population?

Word count: 4683

Key words: Physical activity; IPAQ; Body Mass Index; Waist Circumference

Choice of Journal

Rationale

The present research examines the relationship between physical activity levels and weight status of a Maltese adult sample. The Journal of Physical Activity and Health accepts papers that examine the behaviour, community and environmental interventions that may affect physical activity on an individual and/or population basis. Thus, the present research is deemed to be in conformity with the requirements requested by the journal.

Abstract Research Project

Objective: The aims of this study are to present information regarding PA levels and body composition based on body mass index (BMI) and waist circumference (WC) in a sample of Maltese adults and to investigate if there is a relationship between physical activity (PA) levels, BMI and WC and to explore any association between these variables and the subjects' socio-demographic characteristics.

Method: Four hundred sixteen (416) Maltese citizens between the ages of 18-65 years filled in the International Physical Activity Questionnaire (IPAQ) long form and a general information sheet and were subjected to anthropometric measurements. Chi-squared and analyses of variance with post hoc analysis were used to investigate possible association between socio-demographic variables with BMI, WC risk level and PA level. Chi-squared tests and ANOVA were used to determine whether there is relationship between PA levels, BMI, WC risk and total sitting time.

Results: No significant relationship was found using the X^2-test between PA levels and BMI (X^2=0.440, *df*=4, *p*=.979) and between PA levels and WC risk levels (X^2=1.748, *df* = 4, *p*=.078). A significant association was found between WC risk level and age (X^2 =40.259, *df*=8, *p*=.000) and education (X^2 =10.583, *df*=4, *p*=.032). BMI was found to be associated with gender (X^2 = 18.079, *df* = 2, *p* =.000) and depended on age (X^2 =27.472, *df*=8, *p*=.001). BMI and WC were strongly associated (r_s=.742, *p*=.000).

Conclusion: No significant relationship was found in this research between PA levels measured using IPAQ long form and BMI or WC risk level. Forty two %, 39% and 19% of the respondents were classified in moderate, high, and low levels of PA respectively. However, given the extent of misreporting in many PA surveys, it remains unclear whether these high PA levels observed reflect reality and whether the cutpoints for the IPAQ classification of PA are too low.

2.0 Aims and Significance of the Research

The high rates of physical inactivity and excess weight among the Maltese population is of great concern. Studies on PA and obesity prevalence in the Maltese adult population are limited (National Health Interview Survey [NHIS], 2003; European Health Interview Survey [EHIS], 2008; European Health Examination Survey [EHES] pilot study 2010; European Commission [EC], 2004, 2006, 2010), thus, awareness of the potential impact of PA on weight in Malta is unclear. Therefore, the information provided by this research can be a valuable addition to the existing limited literature and can be beneficial in designing and implementing effective health promotion programmes targeting individuals of different age groups.

2.01 The primary aims of the research

a) To present information about the PA profile and weight status of a sample of adult Maltese population.

b) To explore if there is a relationship between participants BMI categories in relation to their PA levels based on the scoring in the IPAQ (long form).

c) To explore if there is a relationship between participants WC class in relation to their PA level based on the scoring in the IPAQ (long form).

d) To investigate the influence of socio-demographic measures, including, age, gender and education level on PA and WC and BMI.

2.02 Ethical approval

Ethical approval was granted from the Faculty of Applied Sciences, Research Ethics Committee at the University of Chester, UK (A1). All participants gave informed consent before participation in accordance with the ethical guidelines.

2.03 Hypothesis of the research

The research null hypothesis (H_O) could be stated as follows:

H_O^1: There is no significant relationship between PA levels (IPAQ) and BMI.

H_O^2: There is no significant relationship between PA levels (IPAQ) and WC.

2.1 Method

2.1.1 Participants

Clients, members from a social club, friends and others who were invited to participate in the study constituted the sampling frame. To be eligible, subjects had to be Maltese citizens, not pregnant and between the ages of 18-65.

2.1.2 Sample size and response rate

Four hundred sixty questionnaires were distributed, to Maltese citizens, of which 436 were collected. Out of these, nine were excluded as they were outliers, with more than 960 minutes of PA per day (IPAQ, 2005a). Another 11 were excluded as they had a missing sheet or were not properly filled in. This formed a response rate of 90%, of which 182 were men (44%) and 234 were women (56%) for a total of 416 respondents (N=416, 100%).

2.1.3 Research methods

Participants were given a "recruitment" and an "information" sheet which included information about the purpose of the research, confidentiality, voluntary participation and the ability to withdraw at any time without explanation (A5 and A6). A consent form was signed by all participants before anthropometric measures were taken by the author (A7). A translated Maltese version of IPAQ long form (A 8b) was distributed. The English version was also available (A 8a). A general information sheet was included with the IPAQ, asking for self-reported socio-demographic questions (gender, age, education level and status). Most participants answered the questionnaire there and then and some returned it within 15 days. The questionnaires were checked for completion and fully completed questionnaires were allotted a number based on the order in which they were received from participants (A4). The data was then entered into SPSS for analysis and outliers were removed (A9), as indicated by guidelines for data processing and analyses of the IPAQ (2005a).

2.1.4 Translation of IPAQ

The "forward-backward" (IPAQ, 2005b) standard procedure was used to translate the IPAQ long form from English to Maltese according to the instructions given in the IPAQ manual for reliability and validity (IPAQ, 2005b). A final version was provided with some minor changes applied to make the questions more culturally relevant to the Maltese environment (A3). A small pilot test (A8b) involving ten participants was administered to test the IPAQ long form in Maltese, to check that it took about fifteen minutes to answer and to tackle any difficulties.

2.1.5 IPAQ long from

The IPAQ has been tested for reliability and validity and used internationally and in different settings (Ali-Vasheghani-Farahani, et al., 2011; Bauman et al., 2009; Bauman & Marshal, 2001; Craig et al., 2003; Hagströmer, Oja, & Sjöström, 2007; Lee, Macfarlane, Lam & Stewart, 2011; Van der Ploeg et al., 2010).

IPAQ long form assesses PA in four domains (work, transport, home and leisure). Additionally, it measures the minutes of total sitting time in a weekday and in a weekend day, separately (including sitting whilst travelling). Only PA lasting 10 minutes should be recorded. The IPAQ data were converted into metabolic equivalent (MET) scores according to the activity (vigorous activity, moderate activity and walking) and multiplied by the duration (in minutes) of the activity per week (MET-min/wk). A total PA score was then calculated by summing up the MET score over the different activities (IPAQ, 2005a). The average MET value for walking is 3.3, 4 for moderate intensity and 8 for vigorous activity. Cycling and vigorous garden activities are coded as moderate–intensity activities (MET value of 6 and 5.5). The PA levels were recoded into three categorical scores corresponding to low, medium and high levels of PA (IPAQ, 2005a).

2.1.6 Anthropometric measures.

After signing the consent form, each participant was measured by the author for body weight, height and WC, following the same order for every participant, to avoid examiner variability and to reduce misreporting of weight, height and WC which

is common in self-reporting questionnaires (Gorber, Tremblay, Moher, & Gorber, 2007; Rothman, 2008). For all anthropometric measurements, the subjects were in light clothes, bare feet or light socks, with weight evenly distributed on both feet, arms by the sides, and looking straight ahead. Body weight was measured to the nearest 0.1 kg using electronic scales (Weylux 284 BMI). Height was measured to the nearest 0.5cm using a portable stadiometer (Seca 213). The headboard of the stadiometer was positioned so that it touched the highest point of the head. WC was measured using waist watcher tape to the nearest 0.5cm. At the end of expiration, with abdomen relaxed, the subjects were measured with the measuring tape placed horizontally at about the level of the umbilicus between the last rib and the iliac crest as suggested by Lean, Hans & Morrison (1995). BMI was calculated as weight in kilograms (kg) divided by squared height in meters (m^2) and individuals were classified as underweight (BMI <18.4 kg/m^2), normal weight (BMI between 18.5 and 24.9 kg/m^2), overweight (BMI between 25 and 30 kg/m^2) or obese (BMI > 30 kg/m^2).

The main criteria for the selection of IPAQ, BMI and WC as instruments to measure PA levels and weight status were that they had to be practical, quick, valid, reliable, applicable to large groups, cost effective, of low subject burden and of minimal discomfort to participants and that they required no sophisticated equipment. (Craig et al., 2003; Flegal et al., 2009; Janssen et al., 2002; NICE, 2006).

2.1.7 Statistical analysis

After having defined all variables in the questionnaire, all data were entered into SPSS spread sheet (data editor) accordingly. The Statistical Package for Social Sciences (SPSS) version 20 for Windows (SPSS Inc., Chicago, IL) was used for all data analyses. The continuous PA scores obtained from the IPAQ long form were converted into METs-min/wk, and were computed for each subject according to the IPAQ scoring guidelines. PA was also recoded into three categories of PA levels (low, moderate and high), for categorical analysis using Chi-squared (X^2) test (Table 2 and 3). PA score was also transformed logarithmically, to restore the variable to normality. This enables the use of classical analysis of variance on the transformed version of such variable. The data's normality of distribution was checked using Kolmogorov-Smirnov test (Table B6), whilst Levene's statistic was used to check homogeneity of variance. The logarithmic transformation was applied to the average daily sitting time. Means and confidence intervals of these variables could be obtained for each group by transforming the logged variable back to the original.

Analysis of variance, both parametric and non-parametric, was used to test for dependence of PA and sitting time on the various grouping variables. Post-hoc tests were used to determine which groups differed from each other.

For variables that were nominal or ordinal the X^2 test was used to investigate if there is an association between subjects' anthropometric measures (BMI and WC risk),

and their socio-demographic characteristic (age, gender, education level) (Table 1 and Table B2 and B3).

The level of statistical significance (alpha level) was set at $a < 0.05$, while all p values two-tailed (Franks & Huck, 1986). Continuous variables are presented as mean ± standard deviation (*SD*), and/or medians and quartiles. In the case of transformed variables, PA and sitting time 95% confidence intervals (95% C.I.) are presented instead of the *SD*. Categorical variables are presented as frequencies (numbers of subjects) and relative frequencies (percentages).

2.2 Results

2.2.1 Descriptive Characteristics of Research Subjects

Socio-demographic and anthropometric characteristics of the participants are presented in Table 1. In all, 416 participants were eligible, 182 (44%) males and 234 (56%) females. Overall, the mean ± *SD* for weight, height, BMI, WC was 78.4 (±18) kg, 165.9 (± 9.6) centimetres (cm), 28.4 (±5.2) Kg/m^2, and 92 (±14.2) cm, respectively (Table 1).

No subjects were underweight, 30%, 37% and 33% of the respondents were of normal weight, overweight and obese respectively (Table 1). This makes 70% of the subjects overweight or obese of which 2.4% were morbidly obese. Cross tabulation of BMI by gender shows a significant association ($p < .000$) between these two variables (43% males obese as opposed to 26% females). No significant association was found

between BMI and education (p = .407) although the % of overweight and obese subjects seems to decrease from 86% in the primary education group to 66% in the tertiary group (Table B2). Conversely, in the cross tabulation of BMI by age (Table B2) the proportion of obese subjects seems to increase with age, starting from 18% of the 18-24-year-olds, and gradually increasing to 54% of 55-65-year-olds (p= .001). This can also be seen in Figure 1.

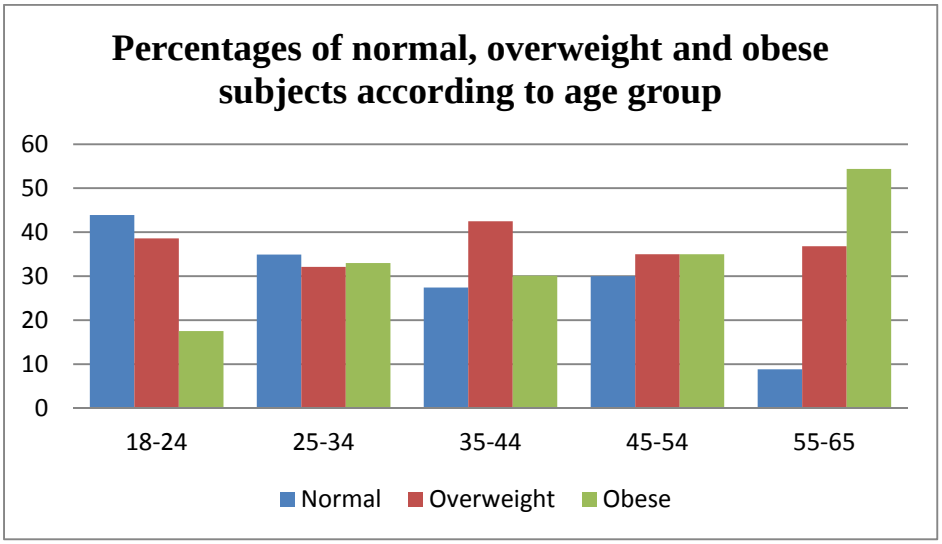

Figure 1: *Percentages of normal, overweight and obese subjects according to age group*

As for the WC risk, 35%, 22% and 43% were of low risk, increased risk and high risk respectively (Table 1). However, no association was found between WC risk class and gender (p = .094, Table 1 and Figure B3). Furthermore the table of WC risk by education (Table B3), shows that higher level of education is associated with less WC risk, although this effect is not large (p = .032) and the proportion of subjects at high WC seems to increase with age (p = .000, Table B3).

Table 1: *Anthropometric characteristics of research subjects by gender*

Gender	***Total N=416(100%) Mean (±SD) Quartiles***	***Males n=182 (44%) Mean (±SD) Quartiles***	***Females N=234 (56%) Mean (±SD) Quartiles***
Body Height (cm) †	165.9(±9.6) 158.0, 164.5, 173.5	173.4 (±7.7) 168.4, 174.3, 178.6	160.0 (±6.2) 156.0, 159.1, 163.6
Body Weight (kg) †	78.4(±18) 65.2, 75.9, 90.0	88.9 (±16.9) 76.2, 87.0, 98.1	70.3 (±14.2) 59.1, 68.1, 77.5
BMI (Kg /m^{-2}) †#	28.4 (±5.2) 24.1, 27.7, 32.0	29.6 (±5.4) 25.4, 29.0, 33.0	27.4 (±5.0) 24.0, 26.2, 30.0
WC(cm) †	92 (±14.2) 82.0, 90.8, 102.9	97.9 (±13.1) 86.9, 96.5, 107.0	87.5 (±13.5) 77.0, 85.8, 96.1
For all variables, Kruskal-Wallis test is significant; p < 0.000			
BMI CLASS	***N (%)***	***n (%)***	***n (%)***
Normal Weight (18.8-24.9 Kg/m^2) ‡	123 (30%)	*38 (21%)*	*85 (36%)*
Overweight (25.0- 29.9 Kg/m^2) ‡	154 (37%)	65 (36%)	89 (38%)
Obese (>30 Kg/m^2) ‡	138 (33%)	79 (43%)	60 (26%)
TOTAL	*416 (100%)*	*182 (100%)*	*243 (100%)*
Significant: X^2 = 18.079, df = 2, p = 0.000			
WC Class	***N (%)***	***n (%)***	***n (%)***
Low risk‡‡	146 (35%)	74 (41%)	72 (31%)
Increased risk ‡‡	93 (22%)	35 (19%)	58 (25%)
High risk ‡‡	177 (43%)	73 (40%)	104 (44%)
TOTAL	*416 (100%)*	*182 (100%)*	*234 (100%)*
Not Significant: X^2 = 4.179, df = 2, p = 0.094			

****Definition of abbreviations and symbols***: **N**= number of subject in total, **n**= number of subjects in subgroups, **SD** =standard deviation, **cm** =centimetres, **m**= metres, **kg**= kilograms, **BMI** =body mass index, **WC** = waist circumference.

†# Measured BMI was calculated using physical measures of height and weight

† Anthropometric characteristics are presented as means ± SD.

‡ Cell frequencies of BMI by gender are presented, together with % within gender.

‡‡Cell frequencies of WC class are presented, together with % within gender.

2.2.2 Physical activity levels analysis

On the basis of IPAQ long form classification criteria (A9), surprisingly, 163 (39%), 176 (42%), 77 (19%) of subjects were classified as highly active, moderately active and low physically active (sedentary) respectively (Table B5 and Figure B1). Tables 2 and 3 shows the descriptive statistical analysis for PA scores in relation to BMI and WC risk (respectively), where the median and means of PA levels and PA continuous scores as well as total sitting time are presented.

2.2.2.1 IPAQ results by BMI and WC

Surprisingly, the highest PA score (median 2473MET -min/wk) was observed among the overweight subjects, while, as expected, the lowest score (median 1915MET-min/wk) was observed among the obese. However, the medians of the three BMI categories were quite similar and the difference between them was not statistically significant (p = .979, Table 2). There was no dependence of sitting time on BMI ($p > .05$). However, as expected, the obese had the highest mean for total sitting time relative to the other BMI groups, and lowest medians in all PA scores or sub-scores.

No significant dependence was found between PA level and WC risk ($p = .078$) and total sitting time by WC risk ($p > .05$, Table 3). Only vigorous PA score was significant ($p = 0.000$).

Table 2: *IPAQ results by BMI (N=416)*

BMI: *PA level*	**Normal** *n (%)*	**Overweight** *N (%)*	**Obese** *N (%)*	**Total** *N (%)*
Low PA levels † †	22 (29%)	28 (36%)	27 (35%)	77 (100%)
Mod PA levels††	53 (30%)	63 (36%)	60 (34%)	176 (100%)
High PA levels † †	48 (29%)	63 (39%)	52 (32%)	163 (100%)
PA by BMI is not significant: $X^2 = 0.440$, $df = 4$, $p = 0.979$; $r_s = -0.018$, $p = 0.716$.				
IPAQ Continuous scores				
PA scores (METs-min/week)	*Median Quartiles*	*Median Quartiles*	*Median Quartiles*	*Median Quartiles*
Total PA score †	2214 933-4428	2473 1214-4115	1915 912- 4326	2164 975-4305
Total Vig PA score †	00 0-800	00 0-510	00 0-400	00 0-480
Total Mod PA score†	1080 240-2400	1230 270-2535	840 120-2400	1010 240-2520
Total Walk PA score †	495 132-1089	594 124-1312	445 99-1386	495 132-1283
Total sit min/day #	330 163-451	326 197-460	330 197-489	328 190-463
For all variables by BMI, Kruskal- Wallis tests are not significant: $p > 0.05$				
Variables	*Mean 95% C.I.*	*Mean 95% C.I.*	*Mean 95% C.I.*	*Mean 95% C.I.*
Total Sit min/day #	314 282-347	322 296-350	335 304-368	324 307-342
Total PA ## Score MET min/wk	2080 1697-2532	2224 1885-2614	1987 1646-2385	2100 1891-2328
Oneway ANOVA on BMI is not significant: for both variables $p > 0.05$				

***Definition of abbreviations and symbols*: n**= number of subjects in subgroups, **C.I.** = confidence interval of mean, **PA**= physical activity, **Vig** = vigorous physical activity, **mod** = moderate physical activity, **Total sit min/day**= total sitting and sitting travel time in minutes per day, **min/wk** = minutes per week.

† † Cell frequencies of PA by BMI are presented, together with % within PA group.

† IPAQ continuous score total PA score, total Vig PA score, total Mod PA score, and total walk score data are presented as METs - min/week in medians and quartiles.

Daily sitting, including travel sitting time per day, presented in minutes/day as means and 95% C.I.

Average PA per week is presented in MET-min/week as means and 95% C.I.

Table 3: *IPAQ results by WC (N=416)*

WC:	**Low Risk**	**Increased Risk**	**High Risk**	**Total**
PA levels	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Low PA levels † †	28 (36%)	14(18%)	35 (46%)	77 (100%)
Mod PA levels† †	61 (35%)	38 (22%)	77 (44%)	176 (100%)
High PA levels † †	57 (35%)	41 (25%)	65 (40%)	163 (100%)
PA by WC is not significant: $X^2 = 1.748$, df = 4, p = .078; $r_s = -.023$, p = .641				
IPAQ Continuous scores				
PA scores (METs-in/week)	*Median Quartiles*	*Median Quartiles*	*Median Quartiles*	*Median Quartiles*
Total PA score †	2198 953-4591	2490 925-4069	2052 1052-4239	2164 975-4305
***Total Vig PA score**†	00 0-1440	00 0-480	00 0-240	00 0-480
Total Mod PA score†	720 233-2160	1410 263-2520	900 215-2730	1010 240-2520
Total Walk PA score †	553 124-1436	545 107-990	396 116-1386	495 132-1283
Total sit min/day#	349 223-498	300 184-459	317 180-458	328 190-463
*For Vig, Kruskal- Wallis test is significant by WC: $p = .000$; All the other variables not significant by WC: $p > .05$.				
Variables	*Mean 95% C.I.*	*Mean 95% C.I.*	*Mean 95% C.I.*	*Mean 95% C.I.*
Total Sit min/day #	345 315-376	301 269-335	319 293-347	324 307-342
Total PA Score MET min/wk##	2151 1769-2600	2103 1708-2572	2058 1760-2398	2100 1891-2328
Oneway ANOVA on WC is not significant: for both variables $p > .05$				

***Definition of abbreviations and symbols*: n**= number of subjects in subgroups, **C.I. =** confidence interval of mean, **PA**= physical activity, **Vig** = vigorous physical activity, **mod** = moderate physical activity, **Total sit min/day**= total sitting and sitting travel time in minutes per day

† † Cell frequencies of PA by WC are presented, together with % with the PA group.

† IPAQ continuous score total PA score, total Vig PA score, total Mod PA score, and total walk score data are presented in METs - min/week, as medians and quartiles.

Daily sitting including travel sitting time per day is presented in minutes/day as means and 95% C.I.

Average PA per week is presented in MET- min/wk as means and 95% C.I.

2.2.2.2 BMI and WC

As expected, there is a significant relation between BMI and WC risk (Table B4). A high association between the two variables was found, with 81% of subjects with normal weight falling in the low WC risk category and 86% of the obese falling in the high WC risk group. For this table, X^2 = 250.957, df = 4, p = .000 and Spearmans' correlation r_s = .742, p = .000.

2.2.3 Physical activity in the separate domains

The medians and quartiles of the four PA domains and sub-scores (walking, moderate and vigorous PA) are presented in Table 4. All four domains have a quartile 0, implying that at least 25% of the respondents were not physically active in each of the domains. The work domain had a median of 0 indicating that at least half the respondents did not do any PA at work. This is true also for the vigorous activity sub-score (totalscoreva).

The median for total 'travelmet' (walking or cycling for non-leisure purposes) is only 90.8MET-min/wk, which is equivalent to 4 minutes walking daily. Similarly, 'totalscorewalk' (total walking for leisure, work and other purposes) has a median of 495MET-min/wk, which is equivalent to about 21 minutes walking daily. Sitting time (including sitting during travel) has a median of 327.9 min/day which is equivalent to 5.47 hours/day. This reflects a rather sedentary lifestyle.

Table 4: *Medians and Quartiles for all respondents of four PA domains, PA subscores and daily sitting time. (N=416).*

Variable	***Lower Quartile***	***Median***	***Upper Quartile***
PA domains		*MET- min/week*	
Totalworkmet	0.0	0.0	990.0
totaltravelmet	0.0	90.8	396.0
totalgarhommet	0.0	360.0	1410.0
totalleismet	0.0	240.0	1039.5
PA sub-scores		*MET- min/week*	
Totalscorewalk	132.0	495.0	1282.9
totalscoremod	240.0	1010.0	2520.0
totalscorevig	0.0	0.0	480.0
PA total		*MET- min/week*	
Totalpascore	975.0	2163.8	4305.0
Daily sitting		*Min/day*	
Sittotal	190.2	327.9	462.9

This is also confirmed by the number of subjects with 00MET in the various domains as shown in Figure B2. A striking 276 (66%) and 67 (16%) subjects reported no vigorous and no moderate PA (00 METs) respectively and a further 90 (22%) subjects reported no (00METs) walking in a week (from all domains).

The above considerations contrast with the frequencies in Table B5, where, according to the criteria of IPAQ (IPAQ, 2005), a high proportion of subjects are classified as moderately active (42%) and highly active (39%) with only 19% being categorised as low PA.

2.2.4 PA domain and sub-scores by gender, education and age

Figure B2 shows the number of males and females that reported 00METs of PA in the four domains. Referring to the leisure domain, only 24 (5.8%) of the participants reported that they walk 7 days a week in their leisure time and 223 subjects (54%; 51% males and 56% females) reported that they never walk (Table B7). Additionally only 21% and 25% engage in vigorous PA and moderate PA respectively in their leisure.

Females in this research tend to be more active than males in the home/garden domain (median of 720 as opposed to 60 MET-min/wk, p = .000) and less active in the work domain (132 MET-min/wk for males as opposed to 0 for females, p = .000, Table B8). There was no significant difference between gender and the leisure or travel domains.

Overall, females tend to be more "moderately active" (1230 MET- min/wk as opposed to 720 MET-min/wk; p= 0.006 for males, Table B8). Conversely, the walking PA sub-score is higher in males, 627 MET-min/wk, compared to the females' 396 MET-min/wk (p= .005). Both males and females have 0 median for vigorous PA, indicating the overall lack of vigorous exercise, however, males had a considerable higher upper quartile (1440 MET-min/wk) than females 240MET-min/wk; p = .000)

Dependence of PA domains and sub-scores on education and age are considered in Tables B9 and B10 respectively. The median for PA is higher for the secondary level group than the tertiary level (p = .036), whilst the median sitting time

is higher for the tertiary level than for the secondary one (p = .000). The medians and quartiles are all presented in Table B9. Respondents in the youngest group (18-24-year- olds) are the least active and have the longest daily sitting time, while the older respondents are more active (Table B10).

2.3 Discussion

Apart from presenting information regarding the PA profile and weight status of a sample of adult Maltese population, the main purpose of this research was to investigate if there is a relationship between PA and weight status (BMI and WC) and if there is an association between socio-demographic factor of education, age and gender in relation to PA, BMI and WC.

Based on the research findings, no subjects were underweight and 70% of the study population were classified as overweight or obese. Other Maltese studies indicate that 67% (MONICA, 1984 as cited in DHIR, 2012), 57% (EHIS, 2002), 59% (EHIS, 2008), 66 % (EHES pilot study, 2010), of the subjects were overweight and obese. This shows a slight increase in the percentage of overweight/obese persons in Malta over the period of 2002 and 2013.

The EHES pilot study (DHIR, 2012) which presents measured weight, height and WC (like the present research) indicates a discrepancy between self-reported measures of obese BMI calculations in EHIS, 2008 (DHIR, 2008) and EHES pilot study, 2010 of 6.8%. This underestimation of self-reported measures was more pronounced

in females with a 10% less being classified as obese in EHES (2008). The underestimation of BMI based on self-reported data was reported in other studies (McAdams, Van Dam, & Hu, 2007; Pirie, Jacobs, Jeffery, & Hannan, 1981; Wing, Epstein, Ossip, & La Porte, 1979). In the present study, in both men and women, high prevalence of overweight and obesity occurred in all ages especially those over 25 (Figure 1 and Table B2). Similar to the EHIS (2008) and EHES pilot study (2010) more Maltese men were reported to be obese, with 43% of males and 26% of females in the obese category (Table 1).

The mean WC of the present study for males and females was 97.9cm and 87.4cm respectively, both in the 'increased risk' category. This is 1.3cm more for the males and 1.9cm less for the females compared to the EHIS (2010) pilot study which seems to be the only Maltese study which measures WC (DHIR, 2012). When categorising the WC measurements according to the risk thresholds, 44% of the women are in the high risk category compared to 40% of males, and more males (41%) are in the low risk group compared to females (31%, Table 1). This same 10% difference was reported in the EHIS pilot study (2010).

No significant correlation was found between the PA levels of the participants (IPAQ long form) and BMI and WC risk. This implies that all subjects, regardless of BMI and WC class, had similar PA profiles. Nevertheless, this observation contrasts existing literature based on an objective measure of PA assessment that indicates that obese subjects tend to be less physically active than overweight and normal weight subjects

(Davis, Hodges & Gilham, 2006; Tudor-Locke et al, 2010). Furthermore, contrary to the author's expectations, PA levels, as presented in this study, are generally higher than those reported in other studies involving Maltese adult population. However, the other Maltese studies did not use the IPAQ long form in their study, hence, proper comparison can be difficult. The high PA prevalence reported in this research is likely to be related to everyday living rather than PA at leisure. Looking at PA levels in the leisure domain, only 21% and 25% reported vigorous activity and moderate activity and 54% reported that they never walk in their leisure time. Furthermore, it was estimated that the subjects in this sample only walked a total of about 21 minutes daily (median 495MET-min/week) which is 15 minutes less then what was reported in the EC, (2006). Additionally, a striking 62% reported 00MET at work in the last seven days, similar to the EC (2006) where 63% of the Maltese respondents reported no PA at work in the last seven days.

A significant difference was found between gender and work domain and gender and house/garden domain (Table B8). Females seem to be more moderately active than males in the home/garden domain. This is expected especially when considering the fact that 74% of those who are non-employed are females. Males seem to be more highly active than females especially in the work domain. These findings seem to be consistent with previous studies (EHIS, 2008; CDC, 2004; Forrest et al., 2001; Ali-Vashaghani et al., 2011). However, one cannot rule out the over-reporting of self-reporting PA (Graff-Iversion et al., 2007; Rzewnicki et al., 2003) and the difficulty of some subjects in distinguishing between vigorous and moderate PA

(Craig et al., 2003; Slattery & Jacobs, 1995; Slootmaker, Schuit, Chinapaw, Seidell & Van Mechhelen, 2009).

The proportion of the research subjects who were sufficiently and vigorously active, based on three or more days of vigorous intensity activity of at least 20 min/day, was 39% (43% males and 36% females). A further 42% (37% males and 47% females) reported sufficient moderate and walking activity based on five or more days of moderate intensity activity and walking of at least 30 min/day. The prevalence of high PA category estimates from IPAQ was reported by other investigators (Brown, Bauman, Chey, Trost, & Mummery, 2004; Graff-Iversen et al., 2007; Rzewkicki et al., 2003). This could be due to the overreport of PA when using IPAQ long form when compared to other objective measures of PA (Rzewnicki et al., 2003; Sallis & Saelens 2000) and due to the fact that IPAQ long form gives more precise PA quantification as it provides more detailed information and measures four domains of PA (IPAQ, 2005a). One can aslo question whether the cutpoints for the IPAQ classification of PA are too low.

2.3.1 Limitations and Strengths

Limitations of the research have to be acknowledged before interpreting the results of this study. Although 416 is a good sample, it is a convenient sample rather than a random sample, since any subject who wanted to take part was welcome. This may have inflated the estimates therefore caution should be exercised in generalising the results.

For practical reasons the IPAQ questionnaire was used to assess PA. However, self-reporting of PA is a key concern in how accurately the subjects reported their habitual PA in the last seven days. Self-reporting questionnaires are subjective and prone to recall bias, social desirability and misreporting (Adams et al., 2005; Maddison et al., 2007; Prince et al., 2008; Rzewnicki et al., 2003; Slootmaker et al., 2009). Besides, the fact that most daily activities are sporadic may lead to inaccurate recall and significant overestimation of time spent on daily activity (Slootmaker, et al., 2009). Furthermore, less fit individuals can rate activities at higher intensity than more fit individuals (Montoye, Kemper, & Saris, 1996). These factors may have led to misclassification of the true PA levels.

In addition, the research outcomes may have been influenced by seasonality in PA patterns, since the data were collected in Malta in early June (2013), when it starts to be too warm to exercise. The opposite could happen in cooler countries, where some people might start to exercise more as warmer weather and longer day light hours can motivate people to be more physically active, spending more time outdoors in activities such as gardening and walking (Buchowski et al., 2009; Chan, & Ryan, 2009; Dannenberg, Keller, Wilson, & Castelli, 1989; Graff-Iversen et al., 2006; Tucker & Gilliland, 2007). Furthermore, the fact that in this research, most of the respondents were from the more rural North of Malta, may have affected the results, because as the EC (2006) indicate, respondents from rural parts are more likely to perform vigorous activities.

Overweight and obesity were measured indirectly by measuring body weight BMI and WC which, although conducted by the author to reduce bias, might not have captured variations in fat and fat free body mass (Frankenfield, Rowe, Cooney, Smith, & Becker, 2001).

The study has important strengths. Anthropometric measures were done by the author following the same pattern with each subject to reduce examiner variability and bias of self-reporting measurements. Finally, IPAQ long form provides more precise PA quantification as it gives detailed information on the four PA domains as well as total sitting time (IPAQ, 2005a; Van der Plog et al., 2010). Furthermore, IPAQ long form is a translated, internationally recognised questionnaire which is reliable and validated, (Craig et al., 2003) while the few other studies assessing PA in Maltese subjects have used PA questionnaire designed especially for their study or the IPAQ short form.

2.3.2 Recommendations for future action and research

In view of the lack of epidemiological data regarding PA levels and weight status of the general Maltese adult population, future nationwide representative sample studies and investigations, using a combination of different, objective, valid and reliable measures of PA and obesity, are required. Stronger evidence and research on both PA and obesity prevalence in the Maltese population can help public health policy makers in Malta design and implement effective prevention and health promotion strategies to combat obesity, sedentarism and to enhance physical fitness

in Maltese adults catering for different ages and needs. Policy makers should take into consideration the obesogenic environment, biological, psychological, behavioural, and socioeconomic factors of the Maltese islands that can affect obesity and PA participation.

2.3.3 Conclusion

In conclusion, the results of this analysis show that 70% of the study population are overweight or obese. No significant relationship was found in this population between PA levels (IPAQ long form) and BMI or WC. However, given the extent of misreporting in many PA surveys it remains unclear whether the high PA levels observed in this research reflect reality and whether the cutpoints for the IPAQ classification of PA are too low. Both BMI and WC risk seem to depend on age, whilst BMI also depends on gender. Sitting time seems to decrease as PA increases, with the younger subjects (18-24-year-olds) and subjects from the tertiary education group have considerably longer sitting times. The fact that more participants (especially females) are in the high risk WC class than the BMI of obesity suggests that WC can give an earlier indication to start treating obesity. Thus, like previous studies, this research supports the need to measure WC, as well as, BMI in clinical and research settings to evaluate better the health status in both sexes (Dagan et al., 2013, NICE, 2006). The current findings contribute to the growing body of evidence that indicates that age is related to BMI and WC risk class, thus indicating that public health campaigns should consider targeting different age groups separately to combat weight problems and lack of PA.

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Appendices Research Paper

Appendix A

A1: *Ethical Approval from the University of Chester.*

University of Chester

Faculty of Applied Sciences
Research Ethics Committee

frec@chester.ac.uk

Marika Micallef
[redacted]

28th May 2013

Dear Marika,

Study title: **A questionnaire survey to investigate relationships between physical inactivity, BMI and waist circumference in the Maltese population between the ages of 18 and 65.**
FREC reference: **802/13/MM/CSN**
Version number: **1**

Thank you for sending your application to the Faculty of Applied Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described in your application form and supporting documentation.

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application Form	1	March 2013
Appendix 1 – List of References	1	March 2013
Appendix 2 – C.V. for Lead Researcher	1	March 2013
Appendix 3 – Letter of Invitation to Participants	1	March 2013
Appendix 4 – Participant Information Sheet	1	March 2013
Appendix 5 – Participant Consent Form	1	March 2013

FREC B
Approval letter – 2012/13

Appendix 6a – Information Sheet	1	March 2013
Appendix 6b – Written Permission – Central Racing Pigeon Club	1	March 2013
Appendix 7 - Questionnaire	1	March 2013
Response to FREC request for further information and clarification		May 2013
Appendix 6a – Information Sheet	2	May 2013
Appendix 4 – Participant Information Sheet	2	May 2013

With the Committee's best wishes for the success of this project.

Yours sincerely,

Dr. Stephen Fallows
Chair, Faculty Research Ethics Committee

Enclosures: Standard conditions of approval.

Cc. Supervisor/FREC Representative

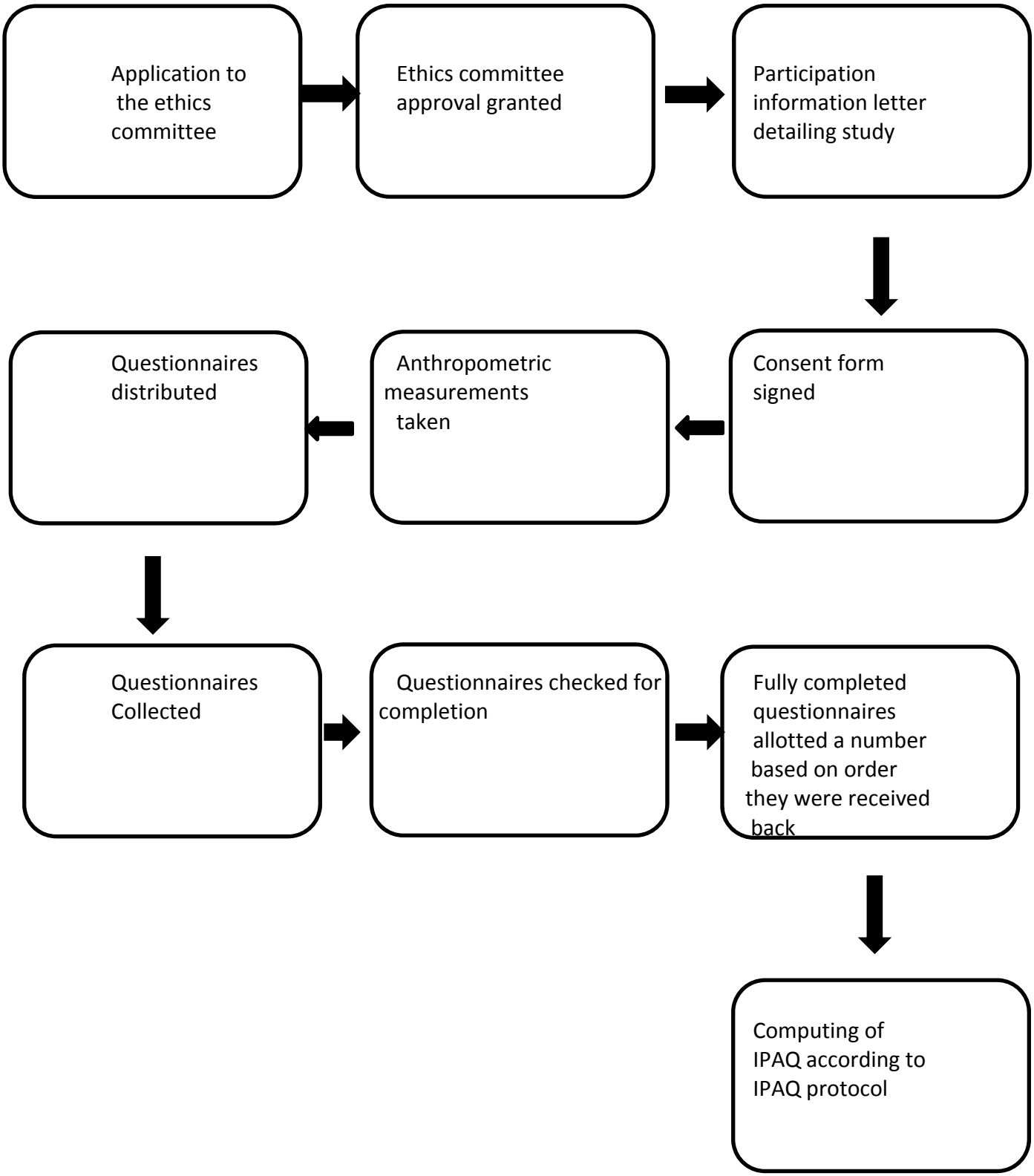
A 2: *Measuring instruments used*

- A digital electronic scales (Weylux 284 BMI, made in UK).
- A potable stadiometer (Seca 213, Hamburg, Germany).
- A 1.5meter long waist watcher tape.
- IPAQ long form questionnaire.
- General questions information sheet.

A 3: *Changes made to IPAQ questionnaire*

Minor modifications were made to questions 8, 14 and 16 as these did not fully apply to the Maltese environment. In question 8, train and tram as a method of travelling were removed as these are not available in Malta and motor cycle was added as it is a popular means of travelling. In question 14, chopping wood and shovelling snow were removed as they do not apply to Malta. And in question 16, washing windows was removed and added to question 18 as in Malta window washing is a house chore.

A 4: *Schematic outline of the study process*



A 5a: *Recruitment Letter in English*

University of Chester

Recruitment Letter

Survey to find if there is a relationship between physical inactivity and weight status.

Dear participant,

As part of my MSc in Weight Management at the University of Chester, UK, I am undertaking a research project designed to investigate the relationship between physical inactivity, BMI and waist circumference in the Maltese population between the ages of 18-65.

I am looking for as many participants as possible to take part. If you choose to participate in this project, I will be taking some measurements, such as weight, height and waist circumference and asking you to complete the enclosed questionnaire and return it to me for analysis. The project is described further in the attached participant information sheet.

To be eligible to fill in the questionnaire, one should be of Maltese nationality, between the ages of 18 and 65 and must not be pregnant.

All information provided will be treated in the strictest confidence, it will be stored securely and will be accessible only to me.

Thank you for your time and help with this survey.

Yours sincerely,

Marika Micallef

A 5b: *Recruitment Letter in Maltese*

University of Chester

Ittra ta' reklutaġġ

Survey biex insib jekk hemmx relazzjoni bejn in-nuqqas ta' attività fiżika u piż.

Għażiż participant/a

Bħala parti mill-istudju tiegħi MSc *f'Weight Management* fl-Università ta' *Chester, UK* qed nagħmel riċerka biex ninvestiga jekk hemmx relazzjoni bejn in-nuqqas ta' attività fiżika u l-piż, BMI u ċ-ċirkonferenza tal-qadd fil-popolazzjoni Maltija ta' bejn it-18 u l-65 sena.

Għandi bżonn kemm jista' jkun parteċipanti, li fil-każ li jaċċettaw ikolli bżonn noħdilhom il-piż, it-tul, u nkejjel d-dawra taż-żaqq, imbagħad kemm jimlew kwestjonarju li jkunu iridu jagħtuni lura biex inkun nista' nagħmel analiżi.
Issib aktar informazzjoni dwar dan il-proġett fil-karta li jmiss li tissejjaħ 'Informazzjoni għall-Parteċipant'

Biex tiparteċipa trid tkun Malti/ja, bejn l-età tat-18 u l- 65 sena u mhux tqila.

L-informazzjoni kollha miġbura hija kunfidenzjali fejn jien biss ikolli aċċess għaliha.

Grazzi tal-ħin u tal-għajnuna tiegħek.

Dejjem tiegħek

Marika Micallef

A 6a: *Participant information sheet in English*

Participant information sheet

Title of study
A survey to investigate the relationship between physical inactivity and weight status in the Maltese population between the ages of 18-65.

You are invited to take part in a research study, but before you decide whether to take part or not, it is important for you to understand why the research is being done and what it will involve. Please read the following information carefully. Please do not hesitate to ask if you need clarification or if you require more information. Take your time to decide whether you wish to take part or not.

Thank you for taking the time to read this.

What is the purpose of the study?
The purpose of the study is to investigate the relationship between physical inactivity and weight status between the ages of 18-65.

Why have I been chosen?
You have been chosen because you are a Maltese citizen between the ages of 18-65

Do I have to take part?
It is entirely up to you to decide whether you want to take part or not. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?
If you decide to take part you will be given this information sheet plus a consent form which will need to be read and signed. Your height, waist circumference and weight will be measured and you will be required to fill in the questionnaire truthfully. The questionnaire involves some general questions about yourself and about your physical activity in the last 7 days.

What are the possible disadvantages and risks of taking part?
There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?
By filling in the questionnaire you can increase your awareness of your own physical activity levels. By taking part you will be contributing to finding out whether the lack of physical activity in the Maltese population as a whole is related to the increased prevalence of weight gain in the Maltese population. The findings will be passed on to the Health Department so that the information can be used in the promotion of physical activity and weight management.

What if something goes wrong?
If you wish to complain or have any concerns about any aspect of the way you have been approached or treated during the study, please contact Prof. Sarah Andrew, Dean of the faculty of Applied Sciences, University of Chester, Parkgate Road, Chester, CH1, 4BJ, U.K. (+44) 1244513055.

Will my taking part in the study be kept confidential?
Yes. All the information collected during the study will be treated in strict confidence and will be seen only by the researcher carrying out the study and the research supervisor within the University of Chester. Your name will not be recorded for any reason.

What will happen to the results of the research study?
The results will be written up in a dissertation. It is hoped that the findings will give an idea of the level of physical activity carried out by the Maltese and if this is related to their weight. A copy of the findings will be forwarded to the Maltese Department of Health in the hope that it will lead to more promotion regarding physical activity.

Who is organising and funding the research?
The research is non-funded and it is being organised with supervision from the Department of Clinical Sciences by Marika Micallef as part of an MSc in Weight Management with the approval of the University of Chester, UK.

Who am I to contact for further information?
If you would like more information about the research before you decide whether or not you would like to take part, please contact:

Name:
E mail:

Thank you for your interest in this research

A 6b: *Participant information sheet in Maltese*

University of Chester

Informazzjoni għall-Parteċipant

Titlu
Survey biex ninvestiga relazzjonijiet bejn nuqqas ta' attività fiżika u piż fil-Maltin ta' bejn it-18 u l-65 sena.

Int ġejt mistieden biex tipparteċipa f'dan l-istudju imma qabel tiddeċiedi jekk tridx tieħu sehem jew le, importanti li tifhem għaliex din ir-riċerka qed issir u x'tinvolvi. Jekk jogħġbok aqra sew din l-informazzjoni. Jekk għandek bżonn tiċċara xi affarijiet jew tkun taf iżjed dwar dan l-istudju tista' dejjem ssaqsini. Ħu l-ħin tiegħek biex tiddeċiedi jekk tixtieqx tieħu sehem jew le.

Grazzi talli ħadt il-ħin biex taqra din l-informazzjoni.

X'inhu l -għan ta' dan l-istudju?
L-għan ta' dan l-istudju hu biex ninvestiga jekk hemmx xi relazzjoni bejn in-nuqqas ta' attività fiżika u l- piż tal-Maltin ta' bejn l-età tat-18 u l-65 sena.

Għaliex gejt magħżul/a?
Ġejt magħżul/a għax int Malti/ja ta' bejn it-18 u l-65 sena.

Bilfors irrid niehu sehem?
L-għażla hi f'idejk jekk tridx tieħu sehem jew le. Jekk tiddeċiedi li tieħu sehem, int liberu li titlaq x'ħin trid mingħajr ma' tagħti spjegazzjoni.

X'jiġri jekk nieħu parti?
Jekk tieħu parti f'dan l-istudju, tingħata din il-karta bl-informazzjoni, trid tiffirma karta li qrajt din l-informazzjoni u li int trid tieħu sehem. Imbagħad neħodlok l-piż, it- tul u nkejjillek iċ-ċirkonferenza ta' qaddek u wara timla l-kwestjonarju li jinvolvi xi mistoqsijiet ġenerali dwarek u dwar l-attività fiżika li għamilt f'dawn l-aħħar sebat (7) ijiem.

X'inhuma l-iżvantaġġi jew riskji jekk tieħu sehem?
Ma hemm l-ebda riskji jew żvantaġġi jekk tieħu sehem.

X'inhuma l-benefiċċji jekk tieħu sehem?
Meta timla l-kwestjonarju ser tkun tista' tinduna kemm tagħmel attività fiżika fil-ġimgħa. Billi tieħu sehem tkun qed tgħin biex insib jekk hemmx relazzjoni bejn in-nuqqas ta' attività fiżika fl-popolazzjoni Maltija u l-piż. Ir-riżultati ser ikunu mgħoddija lid-dipartiment tas-saħħa biex l-informazzjoni tkun tista' tintuża għall- promozzjoni tal-attività fiżika u mmaniġġjar tal-piż.

X'nista' nagħmel jekk xi ħaġa tmur ħażin?
Jekk tixtieq tagħmel xi oġġezzjoni jew jekk għandek xi ħaġa li dejqitek, bħall-mod kif ġejt avviċinat jew trattat waqt dan l-istudju, tista' tikkuntattja lill-Professur Sarah Andrew, Dean tal-fakultà ta' Applied Sciences fl-Università ta' Chester, Parkgate Road, Chester, CH1, 4BJ, UK, (+44) 1244513055

Il-parteċipazzjoni tiegħi ser tkun kunfidenzjali?
Iva. L-informazzjoni kollha miġbura hi kunfidenzjali u tkun użata biss minni u s-*supervisor* tiegħi mill-Università ta' Chester għal dan l-istudju. L-ismijiet mhux ser jidhru mkien.

X'jiġri mir-riżultati ta' dan l-istudju?
Ir- riżultati ser ikunu miktuba ġo *dissertation*. L-għan ta' dan l-istudju hu li nara jekk hemmx relazzjoni bejn il-piż u l-livell tal-attività fiżika. Kopja ta' dan l-istudju ser tgħaddi lid-Dipartiment tas-Saħħa bil-għan li jgħin fil-promozzjoni tal-attività fiżika u l-immaniġġjar tal-piż.

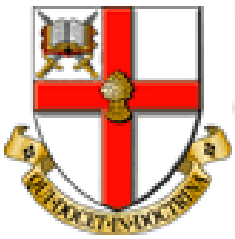
Min qed jorganizza u jipprovdi l-fondi għal dan l-istudju?
M'hemmx fondi provduti għal dan l-istudju. Qed jiġi organizzat minn Marika Micallef b'superviżjoni tad-Dipartiment tax-Xjenza Klinika tal-Università ta' *Chester, U.K.* bħala parti mill-*MSc in Weight Management*.

Lil min nista' nikkuntattja għal aktar informazzjoni?
Jekk tixtieq aktar informazzjoni dwar dan l-istudju qabel tideċiedi tridx tieħu sehem tista' tikkuntattja lil:

Isem:
E mail:

Grazzi tal-interess tiegħek f'dan l-istudju.

A 7a: *Consent Form in English*



University of Chester

Consent Form

A survey to investigate relationships between physical inactivity and weight status in the Maltese population between the ages of 18-65.

Researcher: Marika Micallef

1) I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions. ☐

2) I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. ☐

3) I agree to take part in the above study. ☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of researcher	Date	Signature

A 7b: *Consent Form in Maltese*

University of Chester

Formula tal-Kunsens

***Survey* biex ninvestiga relazzjonijiet bejn in-nuqqas ta' attività fiżika u l-piż fil-popolazzjoni Maltija ta' bejn it-18 u l-65 sena.**

Riċerkatriċi: Marika Micallef

1) Jien nikonferma li qrajt u fhimt din l-informazzjoni dwar dan l-istudju msemmi hawn fuq u li kelli l-opportunità li nsaqsi mistoqsijiet. ☐

2) Jien fhimt li l-parteċipazzjoni tiegħi hi voluntarja u li nista' nieqaf meta rrid mingħajr ma nagħti spjegazzjoni. ☐

3) Jien naċċetta li nieħu sehem f' dan l-istudju. ☐

_____	_____	_____
Isem il- Parteċipant	Data	Firma
_____	_____	_____
Isem ir- riċerkatrici	Data	Firma

A 8a: *Questionnaire in English*

GENERAL INFORMATION

1) Gender: ☐ Female ☐ Male

2) Age:
- ☐ 18 -24
- ☐ 25 - 34
- ☐ 35 - 44
- ☐ 45 -54
- ☐ 55- 65

3) Education level:
- ☐ primary level
- ☐ secondary level
- ☐ tertiary level

4) State:
- ☐ Single
- ☐ Married
- ☐ Widowed
- ☐ Divorced
- ☐ Cohabit

5) Weight: _____ kg

6) Length _____ cm

7) Waist circumference: _____cm

8) BMI: _____kg/m^2

9) How much physical activity is recommended for adults by the Maltese Health Promotion Unit?
- ☐ 1 hour of moderate- intensity daily
- ☐ 30 minutes of moderate -intensity daily
- ☐ 1 hour twice a week
- ☐ 30 minutes five times a week

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

I am interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**.
Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. **Do you currently have a job or do any unpaid work outside your home?**

   Yes ❑

   No ❑

If you answered no ***skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

   ____ days per week

   ____ No vigorous job-related physical activity

If you answered no ***skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

   _____ **hours per day**

   _____ **minutes per day**

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ **days per week**

_____ No moderate job-related physical activity

If you answered no ***skip to question 6***

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ **hours per day**

_____ **minutes per day**

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ **days per week**

_____**No job-related walking**

If you answered no ***skip to PART 2: TRANSPORTATION***

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ **hours per day**

_____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you travel from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** bus, car, or motor cycle?

_____ **days per week**

_____ **No traveling in a motor vehicle**

If you answered no ***skip to question 10***

9. How much time did you usually spend on one of those days **traveling** in a bus, car, or other kind of motor vehicle?

_____ **hours per day**

_____ **minutes per day**

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

_____**No bicycling from place to place**

If you answered no ***skip to question 12***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ **hours per day**

_____ **minutes per day**

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

_____**No walking from place to place**

If you answered no ***skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY***

13. How much time did you usually spend on one of those days **walking** from place to place?

_____ **hours per day**

_____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, or digging **in the garden or yard**?

_____ **days per week**

_____**No vigorous activity in garden or yard**

If you answered no ***Skip to question 16***

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ **hours per day**

_____ **minutes per day**

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, and raking **in the garden or yard**?

_____ **days per week**

_____**No moderate activity in garden or yard**

If you answered no ***skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ **hours per day**

_____ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ **days per week**

_____No moderate activity inside home

If you answered no ***Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY***

19. How much time did you usually spend on one of those days doing **moderate** physical activities **for at least 10 minutes** inside your home?

_____ **hours per day**

_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ **days per week**

_____No walking in leisure time

If you answered no ***skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**

_____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

_____No vigorous activity in leisure time

If you answered no ***skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**

_____ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

_____No moderate activity in leisure time

*If you answered no **skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?

_____ **hours per day**

_____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**

_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ **hours per day**

_____ **minutes per day**

This is the end of the questionnaire, thank you for participating.

A 8b: *Questionnaire in Maltese*

Informazzjoni Ġenerali

1) Sess: ❑ Mara ❑ Raġel

2) Età:
- ❑ 18 -24
- ❑ 25 - 34
- ❑ 35 - 44
- ❑ 45 -54
- ❑ 55- 65

3) Edukazzjoni:
- ❑ livell primarju
- ❑ livell sekondarju
- ❑ livell terzjarju

4) Stat:
- ❑ *Single*
- ❑ Miżżewweġ/a
- ❑ Armel/a
- ❑ Divorzjat/a
- ❑ Ngħix ma' persuna oħra

5) Piż: _____ kg

6) Tul: _____ ċm

7) Ċirkonferenza tal-qadd: _____ċm

8) BMI: _____kg/m^2

9) Kemm hu rakomandat li jsir eżerċizzju mill- adulti skond id- Dipartiment tas-Saħħa ta' Malta?
- ❑ Siegħa ta' eżerċizzju moderat kuljum
- ❑ 30 minuta ta' eżerċizzju moderat kuljum
- ❑ Siegha darbtejn fil-ġimgħa
- ❑ 30 minuta ħames darbiet fil- ġimgħa

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

Jien interesata li nsib informazzjoni dwar x' tip ta' attivita fiżika jagħmlu n- nies bħala parti mill- ħajja tagħhom ta' kuljum. Nixtieq nistaqsik dwar il-ħin li qattajt tagħmel eżerċizzju fiżiku f'dawn l-aħħar sebat (7) ijiem. Jekk jogħġbok, wieġeb kull mistoqsija anke jekk taħseb li mintix daqshekk attiv/a. Aħseb dwar l-attivitajiet li tagħmel fix-xogħol tiegħek, bħala parti mix-xogħol tad-dar u fil-ġnien, biex tasal minn post għal ieħor u fil-ħin liberu tiegħek għar-rikreazzjoni, eżerċizzju jew sport.

Aħseb dwar l-**attivitajiet intensi ħafna** u dawk **moderati** li għamilt f'dawn l-aħħar sebat ijiem. Attivitajiet intensi, jiġifieri, li jirrikjedu sforz fiżiku kbir u jġiegħluk tieħu nifs aktar qawwi minn normal (tilheġ). **Attivitajiet moderati** huma attivitajiet li jirrikjedu sforz fiżiku moderat u jġiegħluk tieħu nifs ftit aktar qawwi minn normal.

SEZZJONI 1: ATTIVITÀ FIŻIKA RELATATA MAX-XOGĦOL

Din il-parti hi relatata max-xogħol tiegħek. Dan jinkludi xogħol imħallas, biedja, xogħol volontarju, *course work* u kull tip ieħor ta' xogħol li mintix imħallas/imħallsa għalih u li sar barra mid-dar. Tinkludix xogħol li għamilt f'dar bħal faċendi tad-dar, xogħol fil-ġnien, manutenzjoni fid-dar u biex tieħu ħsieb il-familja. (Dawn ser issibhom f'sezzjoni 3)

1. **Bħalissa għandek xogħol bi ħlas jew bla ħlas barra mid-dar tiegħek?**

Iva ❑

Le ❑

Jekk irrispondejt **le** mur f'sezzjoni **2: TRASPORT**.

Il-mistoqsijiet li ġejjin jinkludu biss attività fiżika li saret f'dawn l-aħħar sebat (7) ijiem bħala parti mix-xogħol tiegħek barra mid-dar. Ma jinkludux attività fiżika biex vjaġġajt lejn ix- xogħol u lura.

2. F'dawn l-aħħar sebat (7) ijiem kemm-il jum għamilt attivitajiet fiżiċi intensi ħafna bħal irfigħ ta' piżijiet kbar, xogħol ta' tħaffir, tlugħ ta' tarġien bħala parti mix-xogħol tiegħek? Aħseb biss fuq dawk l-attivitajiet fiżiċi li domt tagħmel tal-inqas għaxar (10) minuti kull darba.

____ Jiem fil-ġimgħa

____ Ma nagħmilx attività fiżika intensa relatata max-xogħol.

Jekk ma tagħmilx attività fiżika intensa fix-xogħol tiegħek mur għall-mistoqsija erbgħa (4).

3. **Kemm għamilt ħin, f'wahda minn dawn il-ġranet, tagħmel attività intensa ħafna bħala parti mix-xogħol tiegħek?**

____sigħat fil-ġurnata

____ minuti fil-ġurnata

4. **Aħseb dwar attivitajiet ta' intensità moderata li għamilt f'dawn l–aħħar sebat (7) ijiem li domt tagħmel tal–anqas għaxar (10) minuti kull darba, bħal ġarr ta' piżijiet ħfief. Tinkludix mixi.**

____ Jiem fil- ġimgħa

____ Ma nagħmilx attività fiżika moderata relatata max-xogħol**.**

Jekk ma tagħmilx attività fiżika moderata fix-xogħol tiegħek mur f'sezzjoni sitta (6).

5. **B' kollox kemm qattajt ħin f'attivitajiet fiżiċi ta intensità moderata bħala parti mix-xogħol tiegħek**?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

6. **F'dawn l-aħħar sebat (7) ijiem, kemm-il darba imxejt tal-inqas għaxar (10) minuti kull darba bħala parti mix-xogħol tiegħek? Tinkludix mixi li għamilt biex tasal minn post għal ieħor fix-xogħol tiegħek.**

____ Jiem fil-gimgħa

____ Ma nagħmilx mixi relatat max-xogħol**.**

Jekk ma tagħmilx mixi relatat max-xogħol mur f'sezzjoni tnejn (2).

7. **B'kollox, kemm qattajt ħin fil-mixi, tal-inqas għaxar (10) minuti kull darba bħala parti mix-xogħol tiegħek?**

____sigħat fil-ġurnata

____ minuti fil-ġurnata

SEZZJONI 2: TRASPORT U ATTIVITÀ FIŻIKA

Dawn huma mistoqsijiet dwar kif tivvjaġġa minn post għal ieħor, li jinkludu, fost oħrajn, postijiet ta' xogħol, ħwienet, u postijiet ta' divertiment.

8. F'dawn l-aħħar sebat (7) ijiem kemm-il darba vvjaġġajt b' karozza, karozza tal- linja, mutur jew prajvit?

____ Jiem fil-ġimgħa

____ Ma vvjaġġajtx b'vetturi.

Jekk ma vvjaġġajtx b'vetturi mur għal mistoqsija numru 10.

9. B' kollox kemm qattajt ħin tivvjaġġa b'karozza, karozza tal-linja, mutur jew prajvit f'waħda minn dawn il-ġranet ?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

Issa aħseb dwar il-ħin li qattajt timxi jew issuq ir-rota biex tasal minn post għal ieħor biex tasal ix-xogħol u lura, biex tagħmel xi qadi jew biex tmur minn post għal ieħor.

10. F'dawn l-aħħar sebat (7) ijiem, kemm-il darba soqt ir-rota tal- inqas 10 minuti kull darba biex tasal minn post għal ieħor?

____ Jiem fil-ġimgħa

____ Ma nsuqx rota biex nasal minn post għal ieħor.

Jekk ma ssuqx rota biex tasal minn post għal ieħor mur għal mistoqsija numru 12.

11. B'kollox kemm qattajt ħin issuq ir-rota, tal-inqas 10 minuti, biex tasal minn post għall-ieħor.

____sigħat fil-ġurnata

____ minuti fil-ġurnata

12. F'dawn l-aħħar sebat (7) ijiem, kemm mxejt tal-inqas 10 minuti kull darba biex tasal minn post għal ieħor?

____ Jiem fil-ġimgħa

____ Ma nimxix biex nasal minn post għal ieħor.

Jekk ma timxix biex tasal minn post għal ieħor mur għal sezzjoni 3.

13. **B'kollox kemm qattajt ħin timxi tal-inqas 10 minuti kull darba biex tasal minn post għal ieħor.**

____sigħat fil-ġurnata

____ minuti fil-ġurnata

SEZZJONI 3: XOGĦOL TAD- DAR, MANUTENZJONI F' DAR U XOGĦOL RELATAT MAL- FAMILJA

Din il-parti tinkludi attivitajiet fiżiċi li stajt għamilt dawn l-aħħar sebat (7) ijiem fid-dar tiegħek. Bħal xogħol tad-dar, fil-ġnien, bitħa, manutenzjoni tad-dar u biex tieħu ħsieb il-familja.

14. Aħseb dwar il-ħin li qattajt f'dawn l-aħħar sebat (7) ijiem tagħmel attivitajiet fiżiċi intensivi u li domt tagħmel tal-inqas 10 minuti kull darba, bħal-irfigħ ta' piżijiet kbar, xogħol ta' tħaffir fil-ġnien eċċ.

____ Jiem fil-ġimgħa

____ M'għamiltx xogħol ta' intensità qawwija fil-ġnien jew bitħa

Jekk m'għamiltx xogħol ta' intensità qawwija fil-ġnien jew bitħa mur għal mistoqsija 16.

15. B'kollox kemm qattajt ħin tagħmel attivitajiet fiżiċi intensi tal-inqas 10 minuti kull darba fil-ġnien jew bitħa?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

16. Aħseb dwar attivitajiet ta' intensità moderata li għamilt f'dawn l-aħħar sebat (7) ijiem li domt tagħmel tal-anqas 10 minuti kull darba eż. iġġorr piż ħafif, taħsel il-bitħa, tiġbor il-ħaxix ħażin mill-ġnien eċċ.?

____ Jiem fil-ġimgħa

____ M'għamiltx xogħol ta' intensità moderata fil-ġnien.

Jekk m'għamiltx xogħol ta' intensità moderata fil-ġnien jew bitħa mur għal mistoqsija 18.

17. B'kollox kemm qattajt ħin tagħmel attivitajiet fiżiċi ta' intensità moderata tal-inqas 10 minuti kull darba fil-ġnien jew bitħa?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

18. Erġa' aħseb dwar attivitajiet ta' intensità moderata li għamilt f'dawn l-aħħar sebat (7) ijiem li domt tagħmel tal-anqas 10 minuti bħal iġġorr piż ħafif, taħsel il-ħġieġ, taħsel l-art, tiknes eċċ.

____ Jiem fil-ġimgħa

____ M'għamiltx xogħol ta' intensità moderata fid-dar.

Jekk m'għamiltx xogħol ta' intensità moderata fid-dar mur għal sezzjoni 4.

19. B'kollox kemm qattajt ħin tagħmel attivitajiet fiżiċi ta' intensità moderata tal-anqas 10 minuti kull darba fid-dar?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

SEZZJONI 4: ATTIVITAJIET FIŻIĊI TA' REKREAZZJONI, SPORTS U ĦIN LIBERU

Din is-sezzjoni hi dwar attivitajiet fiżiċi li għamilt f'dawn l-aħħar sebat (7) ijiem bħala rekreazzjoni, sport jew delizzju. Jekk jogħġbok terġax tinkludi attivitajiet li diġà semmejt.

20. Mingħajr ma terġa' tniżżel il-mixi li diġà semmejt kemm-il darba mxejt tal-inqas 10 minuti fil-ħin liberu tiegħek?

____ Jiem fil-ġimgħa

____ M'għamiltx mixi fil-ħin liberu tiegħi

Jekk ma mxejtx fil-ħin liberu tiegħek mur għal mistoqsija 22.

21. B'kollox kemm qattajt ħin timxi fil-ħin liberu tieghek.?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

22. Aħseb dwar il-ħin li f'dawn l-aħħar sebat (7) ijiem li għamilt attivitajiet fiżiċi intensivi li domt tagħmel tal-inqas 10 minuti kull darba bħal *aerobics,* tiġri, issuq ir-rota b'veloċità qawwija, tgħum b'intensità qawwija fil-ħin liberu tiegħek.

____ Jiem fil-ġimgħa

____ M'għamiltx attivitajiet fiżiċi intensivi fil-ħin liberu tiegħi

Jekk m'għamiltx attività fiżika intensiva mur għal mistoqsija 24.

23. B'kollox kemm qattajt ħin tagħmel attivitajiet fiżiċi intensivi fil-ħin liberu tiegħek?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

24. Ahseb dwar attivitajiet ta' intensità moderata li għamilt f'dawn l-aħħar sebat (7) ijiem li domt tagħmel tal-anqas 10 minuti kull darba bħal issuq ir-rota b' ritmu regolari, *jogging* bil-mod, tgħum b'ritmu regolari, u tilgħab *doubles* f' tennis fil-ħin liberu tiegħek?

____ Jiem fil-ġimgħa

____ M'għamiltx attivitajiet fiżiċi moderati fil-ħin liberu tiegħi

Jekk m'għamiltx attivitajiet fiżiċi moderati mur għal sezzjoni 5

25. B'kollox kemm qattajt ħin tagħmel attivitajiet fiżiċi moderati fil-ħin liberu tiegħek?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

SEZZJONI 5: ĦIN LI TQATTA' BILQIEGĦDA

L-aħħar żewġ mistoqsijiet huma dwar il-ħin li tqatta' bilqiegħda waqt ix-xogħol, id-dar, waqt *course work*, u waqt il-ħin liberu tiegħek. Dan jista' jkun ħin li tagħmel bil-qiegħda mal- iskrivanija, għand il-ħbieb, taqra, quddiem il-kompjuter, bilqiegħda jew mimdud/a tara it- televixin.

26. F'dawn l-aħħar sebat (7) ijiem kemm qattajt ħin bilqiegħda f'gurnata matul il-ġimgħa?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

27. F'dawn l-aħħar sebat (7) ijiem kemm qattajt ħin bilqiegħda f'ġurnata matul l-aħħar tal-ġimgħa (*week end*)?

____sigħat fil-ġurnata

____ minuti fil-ġurnata

Grazzi tal-parteċipazzjoni tiegħek.

A9 : *IPAQ Long form scoring protocol and guidelines for computing continuous and categorical scores***.**

Scoring protocol and formulas for computation of continuous scores.

PA score = MET level X (daily minutes of activity) X (days/week)

Vig PA score = 8.0 X (daily minutes of vigorous-intensity activity) X (days/week)

Mod PA score = 4.0 X (daily minutes of moderate-intensity activity) X (days/week)

Walking PA score = 3.3 X (daily minutes of walking activity) X (days/week)

Total PA score = **Vig PA score + Moderate PA score + Walk PA score**

- Participants should only record PA that lasted at least 10 minutes
- Any responses to duration provided in hours- minutes format are converted into minutes.
- Any responses to duration reported as weekly are converted into an average daily time by dividing by 7.
- The recorded PA with duration less than 10 min/day are recorded to zero min/day
- The recorded PA with duration more than 180 min/day are recoded to 180 min/day
- Questionnaires with missing data for time or days or 'don't know/ not sure' are excluded from analysis.
- Questionnaires with total duration > 960 minutes are excluded from analysis.
- Questionnaires with PA frequency >9 days are excluded from analysis.

Recoding of categorical PA Levels

Low level of PA
No activity reported Or Total PA score <600 METs/min/wk

Moderate level of PA
≥3 days of vigorous PA, ≥ 20 min/day of vigorous PA score, ≥ 480METs-min/ wk
Or
>5 days of moderate PA, ≥ 30 min/day of moderate PA score, ≥ 600METs-min/ wk
Or
>5 days of walking PA, ≥ 30 min/day of walking PA score, ≥ 495METs –min/ wk
Or
>5 days of vigorous PA, ≥ total 600 METs –min/wk^{-1}

High level of PA
>3 days of vigorous PA, ≥ Vigorous PA, ≥ 1500 METs –min/wk
Or
>7 days of total PA, ≥ total PA score ≥ 3000 METs –min/wk

****Definition of abbreviations and symbols*: **min** = minutes, **wk** = week, **PA**= physical activity, **Vig** = vigorous physical activity, **mod** = moderate physical activity, **METs**= metabolic equivalents (1MET= 3.5ml 0_2/kg/min, representing the average rate of energy expenditure at rest
All PA scores are expressed as METs – min /wk.

Appendix B

Additional Results

Appendix Table B1: *Age, Educational Level and Marital Status by Gender.*
Frequencies, Column percentages and χ^2 statistics are given.

Age by gender

			Gender		Total
			male	female	
Age	*18-24*	Count	27	30	57
		% within Gender	14.8%	12.8%	13.7%
	25-34	Count	43	66	109
		% within Gender	23.6%	28.2%	26.2%
	35-44	Count	49	64	113
		% within Gender	26.9%	27.4%	27.2%
	45-54	Count	29	51	80
		% within Gender	15.9%	21.8%	19.2%
	55-65	Count	34	23	57
		% within Gender	18.7%	9.8%	13.7%
Total		Count	182	234	416
		% within Gender	100.0%	100.0%	100.0%

$\chi^2 = 8.813$, $df = 4$, $p = 0.066$

Educational level by gender

Education level	*primary level*	Count	7	7	14
		% within Gender	3.8%	3.0%	3.4%
	secondary level	Count	91	124	215
		% within Gender	50.0%	53.0%	51.7%
	tertiary level	Count	84	103	187
		% within Gender	46.2%	44.0%	45.0%
Total		Count	182	234	416
		% within Gender	100.0%	100.0%	100.0%

$\chi^2 = 0.503$, $df = 2$, $p = 0.777$

Table B1 (continued)

Marital status by gender

			Gender		Total
			male	female	
State	*single*	Count	51	57	108
		% within Gender	28.0%	24.4%	26.0%
	married	Count	112	157	269
		% within Gender	61.5%	67.1%	64.7%
	widowed	Count	3	3	6
		% within Gender	1.6%	1.3%	1.4%
	divorced	Count	3	1	4
		% within Gender	1.6%	.4%	1.0%
	cohabit	Count	13	16	29
		% within Gender	7.1%	6.8%	7.0%
Total		Count	182	234	416
		% within Gender	100.0%	100.0%	100.0%

$\chi^2 = 2.714,\ df = 4,\ p = 0.607$

Table B2: *Crosstabulation of BMI group by education and age.*
Frequencies, Column percentages and χ^2 statistics are given.

BMI group by education

			Education			*Total*
			primary level	**secondary**	**tertiary level**	
BMI group	*normal*	Count	2	58	63	123
		% within Education	14.3%	27.0%	33.7%	29.6%
	Over weight	Count	6	81	67	154
		% within Education	42.9%	37.7%	35.8%	37.0%
	obese	Count	6	76	57	139
		% within Education	42.9%	35.3%	30.5%	33.4%
Total		Count	14	215	187	416
		% within Education	100.0%	100.0%	100.0%	100.0%

$\chi^2 = 3.990$, $df = 4$, $p = 0.407$

BMI group by age

			Age					*Total*
			18-24	**25-34**	**35-44**	**45-54**	**55-65**	
BMI group	*normal*	Count	25	38	31	24	5	123
		% within Age	43.9%	34.9%	27.4%	30.0%	8.8%	29.6%
	Over-weight	Count	22	35	48	28	21	154
		% within Age	38.6%	32.1%	42.5%	35.0%	36.8%	37.0%
	obese	Count	10	36	34	28	31	139
		% within Age	17.5%	33.0%	30.1%	35.0%	54.4%	33.4%
Total		Count	57	109	113	80	57	416
		% within Age	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

$\chi^2 = 27.472$, $df = 8$, $p = 0.001$

Table B3: *Waist circumference by education and age.*
Frequencies, Column percentages and χ^2 statistics are given.

Waist circumference by education

			Education level			Total
			primary level	secondary	tertiary level	
WC group	*WC low*	Count	2	64	80	146
		% within Education	14.3%	29.8%	42.8%	35.1%
	Increased Risk	Count	5	52	36	93
		% within Education	35.7%	24.2%	19.3%	22.4%
	High Risk	Count	7	99	71	177
		% within Education	50.0%	46.0%	38.0%	42.5%
Total		Count	14	215	187	416
		% within Education	100.0%	100.0%	100.0%	100.0%

$\chi^2 = 10.583$, $df = 4$, $p = 0.032$

Waist circumference by age

			Age					Total
			18-24	25-34	35-44	45-54	55-65	
WC group	*WC low*	Count	34	44	35	26	7	146
		% within Age	59.6%	40.4%	31.0%	32.5%	12.3%	35.1%
	Increased Risk	Count	8	26	34	12	13	93
		% within Age	14.0%	23.9%	30.1%	15.0%	22.8%	22.4%
	High Risk	Count	15	39	44	42	37	177
		% within Age	26.3%	35.8%	38.9%	52.5%	64.9%	42.5%
Total		Count	57	109	113	80	57	416
		% within Age	100.0%	100.0 %	100.0 %	100.0%	100.0 %	100.0%

$\chi^2 = 40.259$, $df = 8$, $p = 0.000$

Table B4: *Crosstabulation of WC risk group by BMI group.*
Frequencies, Column percentages, χ^2 statistics and correlation are given.

Waist circumference by BMI

			BMIgroup			Total
			normal	Over-weight	obese	
WCgroup	*WC low*	Count	100	43	3	146
		% within BMI	81.3%	27.9%	2.2%	35.1%
	Increased Risk	Count	23	53	17	93
		% within BMI	18.7%	34.4%	12.2%	22.4%
	High Risk	Count	0	58	119	177
		% within BMI	.0%	37.7%	85.6%	42.5%
Total		Count	123	154	139	416
		% within BMI	100.0%	100.0%	100.0%	100.0%

χ^2 = 250.957, df = 4, p = 0.000;
Spearman correlation r_s = 0.742, p = 0.000.

Table B5: *Table showing frequencies and percentages of different levels of PA. A barchart is also presented.*

	Frequency	Percent
PA_Low	77	18.5
Moderate	176	42.3
High	163	39.2
Total	416	100

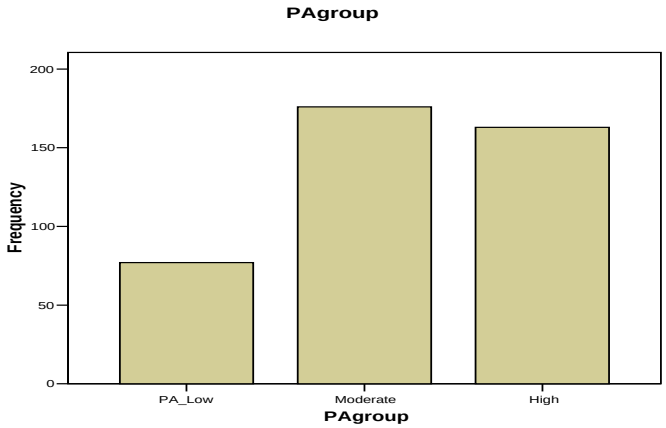


Figure B1: *Percentages of the different levels of PA*

Table B6: *Kolmogorov-Smirnov test of normality for total PA scores and sub-scores, and of some transformed variables.*

Variable	Z	Significance
totalpascore	3.315	0.000
totalscoreva	6.795	0.000
totalscorema	3.625	0.000
totalscorewalk	4.303	0.000
sittotal	1.447	0.030
**** logpa***	0.785	0.568
+ lsittotal	1.242	0.091

*+ transformed variables
* logpa = lg10(400+totalpascore) *or*
totalpascore = 10^logpa – 400.
+ lsittotal = lg10(300+sittotal) *or*
sittotal = 10^lsitttotal – 300.

Table B7: *Frequencies and percentages of number of walking days in the leisure domain*

Leisure walking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No walking	223	53.6	53.6	53.6
	1day	39	9.4	9.4	63.0
	2days	39	9.4	9.4	72.4
	3days	33	7.9	7.9	80.3
	4days	22	5.3	5.3	85.6
	5days	28	6.7	6.7	92.3
	6days	8	1.9	1.9	94.2
	7days	24	5.8	5.8	100.0
	Total	416	100.0	100.0	

Table B8: *Kruskal-Wallis Test for the median of the four PA domains, PA sub-scores and daily sitting time by gender.*
(N Males(M) = 182, N Females(F) = 234).

Variable	χ^2	**df**	***Signif. p***	***Group***	***Lower Quartile***	***Median***	***Upper Quartile***
PA domains						*MET-min/week*	
totalworkmet	26.533	1	0.000 *	M	0.0	132.0	3157.0
				F	0.0	0.0	241.9
totaltravelmet	1.040	1	0.308	M	0.0	66.0	396.0
				F	0.0	99.0	449.6
Totalgarhommet	45.367	1	0.000 *	M	0.0	60.0	773.8
				F	177.5	720.0	1867.5
totalleismet	0.194	1	0.660	M	0.0	198.0	1078.1
				F	0.0	240.0	1032.8
PA sub-scores						*MET-min/week*	
totalscorewalk	7.824	1	0.005 *	M	198.0	627.0	1447.9
				F	24.8	396.0	1014.8
totalscorema	7.465	1	0.006 *	M	112.5	720.0	2145.0
				F	315.0	1230.0	2700.0
totalscoreva	13.578	1	0.000 +	M	0.0	0.0	1440.0
				F	0.0	0.0	240.0
totalpascore	0.081	1	0.776	M	891.0	2139.0	5008.0
				F	1110.0	2286.0	3850.5
Daily sitting							
sittotal	13.115	1	0.000 *	M	257.0	368.6	497.1
				F	162.9	287.1	454.2

***** *Medians of these variables significantly different by gender.*

+ Median of this variable = 0 for males and females, but upper quartile significantly different by gender.

Table B9: *Kruskal-Wallis Test for the median of the four PA domains, PA sub-scores and daily sitting time by education.*
(N Primary(P) = 14, N Secondary(S) = 215, N Tertiary(T) = 187).

Variable	χ^2	**df**	***Signif. p***	***Group***	***Lower Quartile***	***Median***	***Upper Quartile***
PA domains						*MET-min/week*	
totalworkmet	0.344	2	0.842	P	0.0	0.0	3051.0
				S	0.0	0.0	1680.0
				T	0.0	0.0	678.0
totaltravelmet	4.971	2	0.083	P	0.0	0.0	136.1
				S	0.0	49.5	396.0
				T	0.0	99.0	412.5
Totalgarhommet	17.37	2	0.000*	P	127.5	2085.0	3015.0
				S	0.0	630.0	1650.0
				T	0.0	180.0	900.0
totalleismet	3.191	2	0.203	P	0.0	24.8	631.1
				S	0.0	198.0	960.0
				T	0.0	396.0	1314.0
PA sub-scores						*MET-min/week*	
totalscorewalk	1.421	2	0.491	P	0.0	594.0	1212.8
				S	132.0	594.0	1386.0
				T	132.0	462.0	1056.0
totalscorema	17.37	2	0.000*	P	402.5	2085.0	5325.0
				S	240.0	1320.0	2880.0
				T	180.0	720.0	1800.0
totalscoreva	1.879	2	0.391	P	0.0	0.0	720.0
				S	0.0	0.0	480.0
				T	0.0	0.0	800.0
totalpascore	6.817	2	0.033*	P	1235.0	2574.0	7382.6
				S	1215.0	2602.5	4761.0
				T	918.0	1956.0	3546.0
Daily sitting							
sittotal	50.139	2	0.000*	P	210.0	257.1	302.1
				S	154.3	265.7	398.6
				T	282.9	402.9	557.1

** Medians of these variables significantly different by education.*

Table B10: *Kruskal-Wallis Test for the median of the four PA domains, PA sub-scores and daily sitting time by age.*
(N 18-24 years = 57, N 25-34 = 109, N 35-44 = 113, N 45-54 = 80, N 55-65 = 57).

Variable	**χ^2**	**df**	***Signif.*** **p**	***Group***	***Lower Quartile***	***Median***	***Upper Quartile***
PA domains					*MET-min/week*		
totalworkmet	1.720	4	0.787	18-24	0.0	0.0	1534.5
				25-34	0.0	0.0	1314.0
				35-44	0.0	0.0	876.0
				45-54	0.0	0.0	953.3
				55-56	0.0	0.0	519.0
totaltravelmet	7.854	4	0.097	18-24	0.0	99.0	363.0
				25-34	0.0	66.0	371.3
				35-44	0.0	0.0	297.0
				45-54	0.0	198.0	693.0
				55-56	0.0	198.0	594.0
totalgarhommet	23.108	4	0.000*	18-24	0.0	0.0	360.0
				25-34	0.0	360.0	1275.0
				35-44	22.5	510.0	1305.0
				45-54	0.0	600.0	1755.0
				55-56	0.0	637.5	1965.0
totalleismet	7.901	4	0.095	18-24	0.0	264.0	918.0
				25-34	0.0	198.0	1179.0
				35-44	0.0	186.0	795.0
				45-54	0.0	544.5	1499.7
				55-56	0.0	198.0	727.5
PA sub-scores					*MET-min/week*		
totalscorewalk	10.284	4	0.036	18-24	198.0	495.0	1237.5
				25-34	33.0	396.0	990.0
				35-44	0.0	445.5	1039.5
				45-54	297.0	792.0	1765.5
				55-56	198.0	627.0	1410.8
totalscorema	15.390	4	0.000*	18-24	0.0	420.0	1030.0
				25-34	240.0	1140.0	2160.0
				35-44	240.0	1080.0	2700.0
				45-54	360.0	1230.0	2700.0
				55-56	190.0	1410.0	2700.0

Table B10 (continued)

Variable	χ^2	df	Signif. p	Group	Lower Quartile	Median	Upper Quartile
totalscoreva	4.403	4	0.354	18-24	0.0	0.0	600.0
				25-34	0.0	0.0	960.0
				35-44	0.0	0.0	480.0
				45-54	0.0	0.0	570.0
				55-56	0.0	0.0	120.0
Totalpascore	9.593	4	0.048*	18-24	627.0	1236.0	4030.8
				25-34	1182.0	2160.0	3991.5
				35-44	798.5	2092.0	4158.0
				45-54	1437.0	2700.0	4999.5
				55-56	1006.5	2160.0	3844.5
Daily sitting							
sittotal	53.547	4	0.000*	18-24	324.6	458.6	589.3
				25-34	222.9	360.0	499.6
				35-44	183.2	319.3	484.3
				45-54	146.3	225.0	327.9
				55-56	170.1	280.7	380.7

** Medians of these variables significantly different by age.*

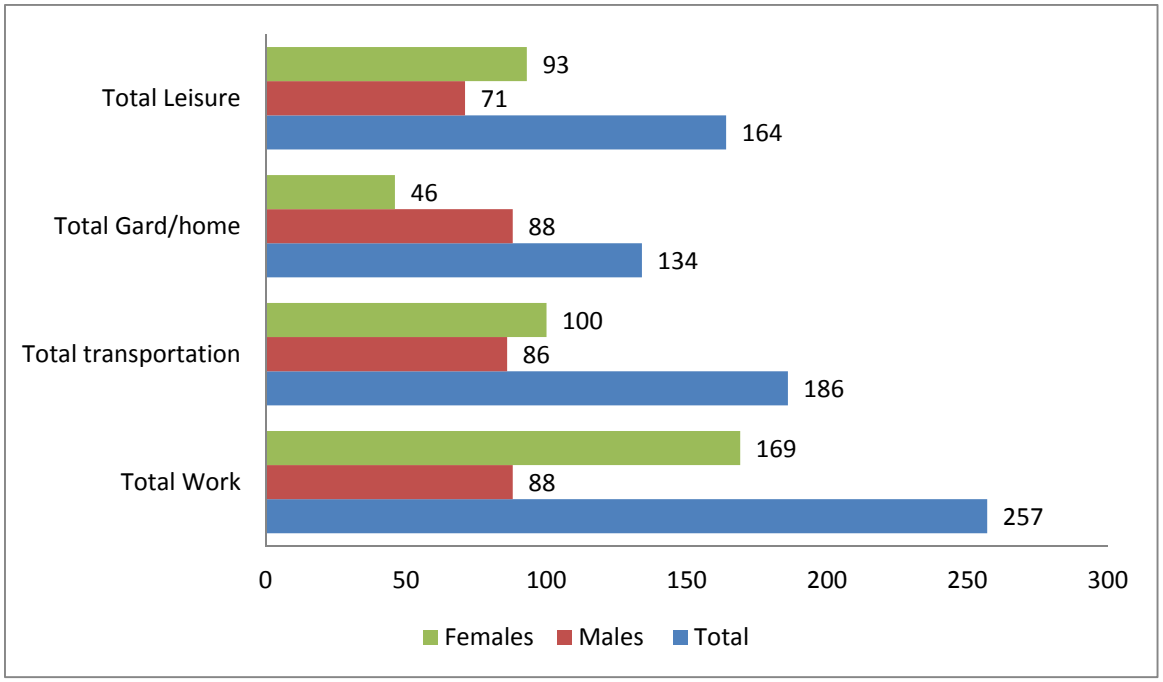


Figure B2: *Number of subjects reporting 00 METs –min/wk in the four domains of the IPAQ.*

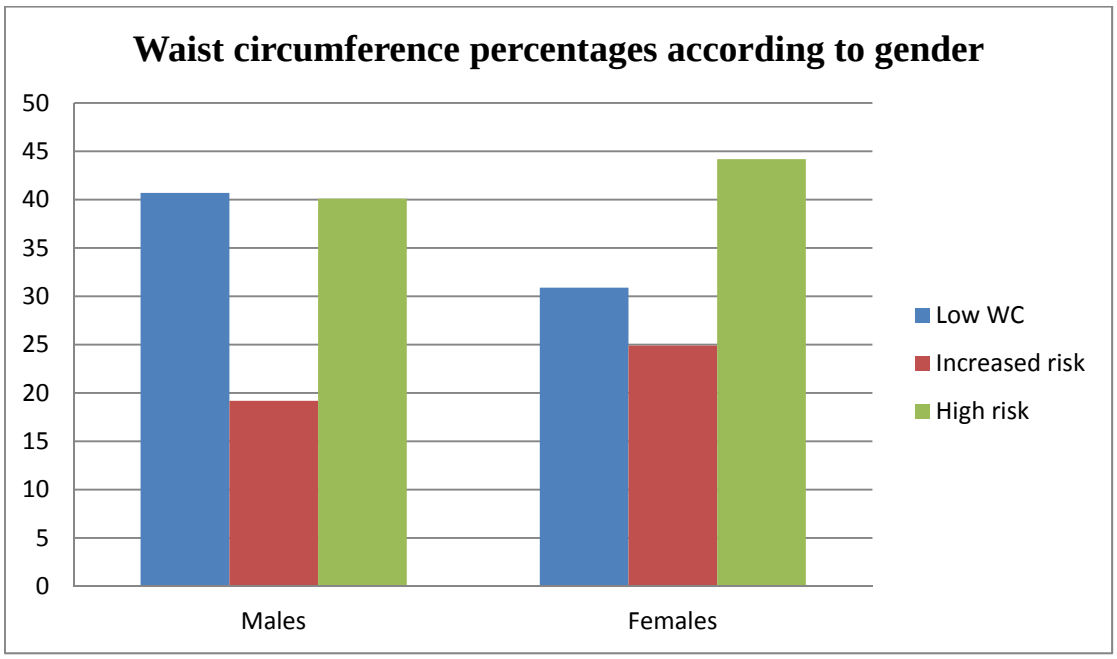


Figure B3 : *Percentages of WC by gender*